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TEACHERS COLLEGE RECORD

Language Activities as Experience*

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THE opinion that linguistic activity, especially reading, is not "real" experience, not direct experience, but another kind, usually called vicarious experience or mere verbal activity, which appears to be something distinct from and inferior to "real" experience, has been expressed frequently. It has been voiced by some of the students of semantics. For example, Korzybski[1] has stated a conviction that our verbal methods of education impose serious limitations on the full flowering of understanding in growing children, and should therefore be delayed and minimized in education. This view has been espoused by Jaensch,[2] the father of eidetic psychology. It appears in the writings of many educational theorists and some academic philosophers. It is an interpretation, an erroneous one I am sure, of the Dewey formula, "We learn by doing."

The idea also appears frequently in recent literature on the teaching of reading. For example, in the January, 1953 issue of the *Elementary School Journal* is an article entitled "How to Develop Concepts and Their Verbal Representations." The title itself implies acceptance of this distinction. The author, Mary C. Serra, in reviewing a long list of articles on vocabulary development, finds frequently the assumption that learning, real learning, occurs fundamentally only in direct or real experience.

In the January, 1953 issue of *The Reading Teacher* appears an article which sets forth a procedure to enable teachers to appraise their point of view in the teaching of reading. The author (Daisy M. Jones) writes, "Now examine this set of beliefs. Do you believe. . . ." Then follow four presumably crucial

* A paper read at the annual meeting of the National Council of Teachers of English, Atlantic City, February 17, 1953.

[1] A. Korzybski, *Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics* (Lancaster, Pa., Science Press, 1933).

[2] E. R. Jaensch, *Eidetic Imagery* (New York, Harcourt, Brace, 1930).

beliefs, the last of which is: "4. That experience is the source of information and that the printed page merely recalls meaningful associations?" According to the author, if you believe this and the other three statements, "your objective is the comprehension of meaning," and you apparently merit the highest rating for your point of view as a teacher.

Uppermost for consideration in this discussion is whether this sharp distinction between real or direct experience and vicarious experience (the classification for reading or talking about things) has been pushed beyond reasonable limits and threatens to lead to an unsound educational policy.

For three-quarters of a century the psychological laboratory has been demonstrating the fact that securing insight and understanding in the course of direct or real experience is an exceedingly intricate and difficult process. Our ordinary, everyday perceptions of common objects and situations are often inexact, superficial, and faulty. The experiments on observation and reports and on perceptual illusions and recall demonstrate the unreliability of our testimony concerning the most commonplace objects and activities. When the test called for insights and understandings, the results showed direct experience to be even more unreliable, as many of the old experiments in which simple dramatic scenes were enacted by previous arrangement testified.

The reader will perhaps recall Darwin's comment, after his rare mind achieved the conception of natural evolution, that he was amazed by the obviousness of the evidence of this idea at every turn of his eye on the countryside. An average college student, after reading a chapter on this topic, can see and interpret things in the world about him to which all our greatest minds before him were quite blind. We glory in the tremendous strides which science has achieved in increasing insight and understanding of natural phenomena, but we should recognize how extraordinarily infrequently and tortuously we achieved these insights which, once discovered, jump out at us on every hand. The same situation prevails in other areas. For example, what we have learned in psychology and psychoanalysis indicates how superficial are most of our interpretations of the real significance of the behavior of other persons.

Mere provision of real or concrete experience is no guarantee that learners will be provided with an easy avenue to significant insights and concepts. The illiterate child of nature, of whatever age, is a notoriously ignorant person. It is not easy to see that, if the assumption that real experience is so much more fertile than verbal experience is correct, we are doing a child a service by talking to him at length or by removing him from the manifold activities of the free life at large to the schoolroom.

The fact that achieving insights by direct sensory experience is difficult is, of course, no proof that reading and listening are any less "vicarious" or any easier or more fruitful.

Evidence on the nature of and possibilities inherent in verbal experience is difficult to present. There is considerable evidence, however, in support of the view that language experiences are not only highly rewarding but also the indispensable means to insight and wisdom. Most of the world's outstanding theorists in psychology have assumed, in one fashion or another, that most or all crucial concepts are achieved in verbal form. It is the assumption that language and thought, verbalization and

real insight, evolved together both in the individual and in the race. Scarcely a book in psychology fails to point out that the distinctive characteristic of *Homo sapiens* is his language. Language is the base, the mechanism of thought. Thinking goes on largely in verbal form. Understanding moves forward hand-in-hand with mastery of language. It should be noted in passing that, theoretically, no distinction is here made between reading verbal material and listening to verbal material. The distinction is entirely a practical one. The stimuli in one case are light waves and in the other sound waves. Any statements that can be heard can be read.

Insight and understanding depend upon a broad unity of experience which includes both what are popularly called direct contacts and verbalization, that is, talking or reading about such contacts. Any move to establish a dichotomy is, I think, likely to lead us astray.

An attempt to assign an array of activities to one or the other type will quickly reveal the difficulty. Perception of all items is a response to a cue or an aspect of the totality. A child does not simply grasp and swallow whole, intellectually, a big animal or a thunderstorm. He must tediously learn to perceive that one thing is a dog, another a cow, and that the one is farther away at the moment than the other, and that the dog may be vicious. A printed word or a visible dog is not, on first contact, mysteriously photographed in the mind once and for all. Both must be studied, analyzed, and their significance gradually comprehended. Thereafter, each is perceived, or "reintegrated," on the basis of some partial feature, some abstract characteristic.

"Vicarious," according to the dictionary, means "serving as a substitute, taking the place of." When you perceive the word "dog" you are not, in a popular sense, seeing a real dog, but what you "see" when you perceive a "real" dog skulking in the thicket is merely thinking "dog" in response to a fragmentary array of light waves; you are not exactly seeing a whole dog, much less a "dangerous dog." In both cases you are responding to a reduced, partial, abstract cue with a complex conception developed not merely out of your previous contacts with the "real" animals but also out of what you have previously read and heard and thought about dogs. Indeed, your concept may well have been influenced more by the latter than by the former. At any rate, the distinction between "real" and "vicarious" is not clear even in such a commonplace episode.

Is listening to Beethoven's Pastoral Symphony a real or a vicarious experience? Well, you might say the *sounds* are real. But one must inquire, What do you mean by "the sounds"? Do you mean merely the single notes? The melody, however, is not in the notes. It is, as the psychologists say, something that transcends the sensory elements; it is a *Gestalt*. The melody is likely to be more clearly discerned than the individual notes, which you say you really hear, but is a melody real in the sense that the pain from a burning match applied to the finger is real? And what about the idea of the rippling brook and the sudden thunderstorm that come to your mind as you hear this symphony? Surely you would not insist that you had direct contact with a real thunderstorm! When you observe a painting, say Picasso's 1918 "Still Life," are you "seeing" reality or merely a symbol of reality? What about observing Picasso's rather abstract "Card Player"? A bit of thinking about

such situations will convince most persons of the difficulty of classifying them consistently into "real" and "vicarious" experience cubbyholes.

Is it not better to assume that there exist many kinds of experience of which reading and listening to spoken words are two kinds? They are quite as "real" as touching, smelling, seeing, hearing, or otherwise reacting to things and events. The cat's grin, which Alice perceived in Wonderland, without the cat, was quite as real to her as the cat itself. And many psychologists will contend that there is no real difference, psychologically, between perceiving a cat's grin without a cat and perceiving a cat without a grin.

As noted above, it seems frequently to be assumed that reading can revive an experience but that it cannot give new experience. Often it is said that reading cannot give new concepts but it can enrich and enlarge experience. The latter distinction is psychologically far from clear.

Actually the evidence points to the likelihood that reading not only can provide new experience but is an essential component of the totality of activity essential for really insightful activity of any kind. In a charming little book entitled *Reading: An Essay*, Hugh Walpole writes, "But the great thing that the book [he refers to one of his earliest reading experiences, namely, the reading of *Alice in Wonderland*] did for me was for the first time to give me another world to play in. I had not at that period a very amusing world of my own. It was constantly restricted, inhibitions abounded, and almost everything that one liked was bad either for one's stomach or one's morals." He goes on to declare that the new world was a product of his reading as much as of his earlier "direct" experiences and that it was even more illuminating, newer, more creative, if you like, than anything he secured by direct experience. He implies, moreover, that the most crucial insights into his own real world came to him only after he compared it with the world of Alice, which achieved instant reality after he read a book. In essential meanings and in concrete detail the world of reading was as new and as real as the other world.

If one can develop, invent, imagine, contrive an insightful grasp of a physical setting through reading, one can scarcely deny that the possibility of language is even more promising as a means of achieving insight and understanding where complex action is concerned. It is, I think, difficult to imagine that any amount of mixing with people can achieve the subtleties of insight and understanding of different personalities which one may acquire from a program of such contacts combined with reading better works of fiction, psychology, psychoanalysis, religion, and sociology. Psychotherapy, the process of helping an individual achieve a better understanding of himself and his place in the world, whether practiced by a minister, parent, psychoanalyst, or a directive or "non-directive" clinical psychologist, is primarily a verbal process.

The nearer we approach the type of insights which we typically call scientific concepts or ethical abstractions and theoretical principles in general, the more essential the verbal component of experience becomes. Almost all scientific and ethical concepts, for example, were contrived in the medium of, and are embodied in, verbal form. With some exceptions, and even these are questionable, the testimony of great thinkers is that the critical operations are verbal

activities and while some things may lie beyond the verbal, in what Woodworth described as "imageless thought," the latter are, if anything, even farther removed from what many of our educational writers refer to as "real experience." In this sense, modern logic, mathematics, and physics are almost wholly verbal or symbolic in structure, organization, and operation. The scientific method is a derivative of verbal activity and can be conveyed in no other form. In brief, one could defend the view that the most novel, the most conspicuously and subtly new things in the world are intrinsically language achievements.

I have suggested that what we are calling "real experience" can be very unrewarding unless it is selected, organized, pointed up, generalized, its essence extracted and verbalized. I must not make the mistake of implying that reading, mere reading, provides an easy way to wisdom. Education must see to it that it avoids developing what Pope described as the

> Bookful blockhead, ignorantly read,
> With loads of learned lumber in his head.

While reading is the instrument *par excellence* for making experiences of all types meaningful, and while its availability and adaptability make it an exceedingly subtle tool for practical use, it is also prone to operate at a very low, thoughtless recognition level. Unfortunately, it often survives at about the level of lackadaisical listening to an uninspiring lecture. One can move through a book as one can move through a forest or a crowd of people, with little recognition beyond the familiar, aimless in direction and unconcerned with any real problem. There is indeed a real danger, as many have pointed out, that literate persons may be tempted by the sheer wizardry of words to substitute repetitive verbalism for thinking; to offer words for solutions; and to conceal ignorance with easy phrases. This extraordinary flexibility of language as read, heard, or spoken has made people suspicious of it. The range from verbalism to Platonian insight is tremendous, but we must not banish Plato's type of creativeness because some persons bore us with pointless jargon.

Many have deplored the child's tendency to verbalize; have pointed out how glibly people talk without understanding, how often the child's gift of gab fools the teacher. Is this evidence of the poverty of language, or is it evidence of its extraordinary potency? I take it that any child who can fool a teacher in the teacher's specialty is no fool! Here is a lad who shows promise. Whether he becomes a saint, a sinner, a scientist, or a movie script writer, we may not know, but in any case he may exercise great power.

The effective use of language, of reading in particular, as a means of achieving the insights and understandings our citizens require, depends upon proper orientation and motivation and the development of exceedingly intricate techniques of action. We have long greatly underestimated the importance and the subtlety of verbal skills. This is due partly to the mistaken idea that once a youngster can recognize words spoken or seen he has acquired all the basal techniques of reading and listening. In the intermediate and upper grades, teachers' attention has been directed to the products of reading, to what the pupils could report about the substance of their reading in history and other subjects, rather than to the process. Many of them were utterly unaware of the means,

the reading techniques, children were employing to achieve these ends. The fact that the techniques are difficult to see as compared with a child's method of operating a typewriter, for example, lulled teachers into confidence that there was little they could or should do. From recent research and practical experience it is becoming increasingly clear, however, that at this stage the need for insight and guidance in connection with development of reading skills is vital.

We probably underestimate the unrealized possibilities of enlightenment we may hope to achieve through better guidance in utilizing the power of words. I shall not review as evidence the several studies which strongly suggest this, case studies of poor readers whose learning abilities were vastly improved by adequate guidance, or experimental studies, such as those by Glaser,[3] and Bloom and Broder,[4] which have shown how instruction improved ability to think and to solve vital problems in various fields, but I shall report a few observations. First, the child, aged perhaps three and a half, who sidled up to me in a department store. As he besought me to talk to him and tell him about things, I suddenly realized that this child really understood that the meanings he sought concerning what he could see and hear had to come on the wings of words. A few words could cut through to the heart of understanding when long observation failed. It was then I thought of Hitler and how his printed and spoken words turned a quiet world into turmoil. Recently I read in an autobiographical sketch the following comment on Hitler's words: "I heard him. I believed him. Only after long and bitter experience did I learn how wrong he was."

Are we to interpret such a confession to mean that we must beware of words, we must de-emphasize them, we must substitute "real" experience for them? Or shall we recognize that the power of words to determine our understandings and convictions is as promising as it is frightful? Note that the quotation implies really that a few minutes spent in hearing a few pages of words led to ideas which were psychologically the same as those achieved only after "long and bitter experience." The remedy is not to attempt hastily to substitute "long and bitter" experience for words, but to provide truer words, and greater ability to achieve fruitful insights from all words, and to combine more effectively the use of words with other forms of experience. Words are here to stay. We have no choice but to find out how to make the best of them. A first step is to realize that listening and reading are not weak, impotent, vicarious experiences to follow and subordinate to real experience, but a true, indeed possibly the most vital, component of the totality of experiences from which fruitful insights must spring.

This view should not be understood as an argument for minimizing the importance of non-verbal experiences or as a plea for devoting more time in the school or elsewhere to reading and listening to spoken words. In the past, most schools depended upon words too greatly. They were too bookish and too verbal. They failed both to provide adequate opportunities to explore significant phases of the environment—to observe, manipulate, construct, plan, experiment—and to relate the verbal to other activities in such a way as to enable them to inter-

[3] E. M. Glaser, *An Experiment in the Development of Critical Thinking* (New York, Teachers College, Columbia University, 1941. Contributions to Education, No. 843).

[4] B. S. Bloom and L. G. Broder, *Problem-Solving Processes of College Students* (University of Chicago Press, 1950).

penetrate and illuminate each other. Nor is the view here expressed opposed to extensive use of newer media—television, sound-motion and motion pictures, still pictures, mechanical demonstration devices. It is merely a protest against the idea, apparently gaining wide currency in education, that reading, listening, and talking are not really vital experiences but cheap, weak, pedagogical substitutes for experiences. The view here presented is that they are, on the contrary, conspicuously vital, enlightening, and almost alarmingly potent experiences. The problem is to make the best possible use of them, not in the popular sense, as substitutes for other experiences, but in the most illuminating combination with other activities.

Although it is futile to consider a choice between verbal and other experiences, inasmuch as either would be barren without the other, it is nevertheless illuminating to realize the tremendous role language plays in daily life. Consider the surge of learning a child shows once he has begun to understand what is said in his hearing. How much would a ten-year-old boy discern concerning the operation of a radio or an electric motor about which he had never heard or read a word if, at the time he first examined such an apparatus, no word of explanation, oral or written, were available to him. It is easy to underestimate the extent to which the things we tell children or which they read contribute to their understanding of the objects and events they "experience" in their daily lives in or out of school. Indeed, once a child has acquired ability to understand words, substantially every moment of "experience" is accompanied by language. If he is neither reading nor listening to spoken words, he is almost certainly talking to himself or "thinking" in verbal form. The fact that thinking is almost wholly verbal (the exceptional forms are really more subtly verbal than ordinary words in the same sense that mathematical symbols are ultra-verbal) should induce us not to minimize the usefulness of language activities but rather to suggest that they are of supreme importance in the life of insight, understanding, and reason.

> Words are things, and a small drop of ink,
> Falling like dew upon a thought, produces
> That which makes thousands, perhaps millions, think.
>
> —Lord Byron

Some Significant Trends in Science Education*

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BERTRAND RUSSELL in a recent book[1] suggests that science has two functions: "(1) to enable us to *know* things, and (2) to enable us to *do* things." Whether this is an oversimplification, or a too inclusive description of modern science, we will not stop to discuss here. Certainly the knowing-known process guided and controlled by the established procedures of scientific inquiry has achieved first rank in our scale of cultural values and has given us a vast body of dependable knowledge.

This knowledge, with associated skills and techniques, enables us today to do many things that were not possible even a generation ago. Modern technology is undoubtedly the outstanding example of the close relation between knowing and doing. This is clearly seen in our productive processes, in transportation, in distribution of goods, and in such services as medicine and public health. Modern technology does not, however, exhaust the stock of available and tested knowledge, even the knowledge most pertinent to the activities and problems peculiar to the broad field of technology. If a manufacturer chooses to produce a razor blade designed for limited use rather than one which will last indefinitely, he does so today for reasons other than the lack of knowledge and technique to produce the more durable blade.

Similar situations prevail in all areas of human activity and concern. It is one thing to establish with a high degree of certainty that the sun not the earth is the center of the solar system, but quite a different thing to diffuse this knowledge in such a manner as to change the ways of thinking and behavior of a population. Knowledge and technique as to the prevention and cure of syphilis, for example, are well established in medical practice, but the reduction of the incidence of this disease among the population is discouragingly slow. That the wide diffusion of reliable knowledge and technique is of more than passing importance needs no documentation. In fact, this may be considered a central purpose of education, and in achieving this purpose, science education has an increasingly important role to play.

But mere diffusion of knowledge and bare technique are not enough to assure subsequent benefit to the entire population. Verified and tested knowledge and technique should be diffused in relation to the personal and community concerns

* Opening presentation at Work Conference on Science Films, Teachers College, Columbia University, March 13, 1953.

[1] Bertrand Russell, *The Impact of Science on Society* (New York, Simon and Schuster, 1953), p. 18.

of people. And to complicate the situation further, ways and means should be found to include in the diffusion process an understanding of the nature of scientific inquiry and its relation to verified knowledge and technique. Excluding or separating the known (knowledge and technique) from the knowing process (scientific inquiry) would in effect diminish the usefulness of existing knowledge and technique and retard the spread of the methodology of scientific inquiry to areas of human activity other than science. It is not too much to claim that the social validity of scientific knowledge and technique is a function of its relation to, and effect on, the "doing" of a population, when doing is taken to include and *to mean* ways of thinking and behaving. It is in this latter sense that science education finds its chief focus and social justification.

With this orientation in mind, we now turn to a consideration of some significant trends in science education.

SCIENCE EDUCATION AND THE MODERN SCHOOL

Events since 1940 have enhanced the status and importance of science education in American schools and colleges. The prosecution of World War II, the subsequent development of the cold war, and the "atomic crisis" have unprecedented, if ominous, significance for education, particularly science education. "Atomic energy is everybody's business" (to take a dramatic and pervasive example) makes sense only when considered as a direct challenge to our educational enterprise. It now seems clear that if we are to avoid the danger and realize the promise implicit in our times, much greater emphasis on education in general and science education in particular will be necessary.

Present public awareness of the central importance of science and technology in our society will undoubtedly persist. This awareness is reflected, for example, in current agitation over the alleged scientific and technical manpower shortage and, less dramatically, in an increasing concern on the part of the general public (including educators) for the quality and quantity of science education at both the elementary and the high school level. As schools and colleges face new demands and expectations, they are forced to deal with an expanding and changing school population in a context of unprecedented problems and shortages of serious proportions. Although the future seems uncertain and is complicated by unknown variables, it might be interesting to consider a few general facts and to venture a few predictions regarding the future of science education in American schools.

1. Science in the elementary school is decidedly beyond the "frill" stage; it has become an essential element in the education of all children. Therefore, the elementary science program will continue to expand and will become rich and inclusive enough to provide continuous opportunity for children at each age level to develop existing and latent science interests and to satisfy their needs in a manner satisfactory to them. The present dilemma of the elementary school, due to a greatly increased school population and to shortages in personnel, buildings, and equipment, has undoubtedly hindered the expansion of the science program. It is likely that a smaller percentage of the elementary school population now enjoys adequate science experiences than was true ten years ago. This is, however, a temporary condition.

2. The junior high school is just beginning to feel the impact of a greatly

increased school population. A recent study[2] of a random sample of American high schools indicates that there was a 50 per cent increase in the seventh grade enrollment for the fall of 1952 as compared to 1947. Less dramatic population increases were indicated for the eighth and ninth grades and for the senior high school. Science enrollment in the junior high school, however, has not kept pace with the general enrollment. Educators concerned with the junior high school science program are faced with a tough problem compounded of increased enrollment, shortages in personnel and facilities, and the pressing need to articulate more effectively the elementary and junior high school science programs. It seems reasonable, however, to anticipate and plan for a junior high school science program which will fully capitalize on the elementary science program and provide science experiences geared to the developmental needs and maturing interests of all children.

3. The senior high school does not now and never has fully reflected the common school tradition characteristic of the elementary school, although the right of every youth to a high school education has been implicit in our public school orientation for the past seventy-five years. The senior high school has developed its own tradition as a preparatory school for college, and the science program has been, and to a large extent still is, geared to this tradition. The pressure of events is, however, forcing science educators to reconsider the high school science program.

Enrollment in the senior high school is now beginning to increase and will increase greatly within the next five years, perhaps as much as 50 per cent. Not only will larger numbers of youth enroll in the senior high school, but a larger proportion of each age group will remain in school through the twelfth grade. It is not unlikely that the twelfth grade will sooner or later include all the youth of that age group which reside in the school's community. Whether the actualization of this possibility will force the high school to take on the characteristics of a common school, in the best sense of the term, is not yet clear.

As the high school population changes and becomes more heterogeneous, one would expect similar changes in the groups now enrolled in science courses. This is nearly true for biology and for general science, but enrollments in physics and chemistry courses continue to decline. Since 1947 there has been an actual as well as a per cent decrease in the physics and chemistry enrollments, which still are much less heterogeneous than the total school population. Enrollment in courses other than the four mentioned appears to be increasing. The total enrollment in science courses for grades nine through twelve was more than 50 per cent of all the youth in high school at the beginning of the 1952 school year.

The trend of enrollments in high school science courses, when supplemented with other trends to be noted later, suggests three things:

1. The biological sciences, even as now organized and taught, have a stronger appeal to students than present courses in physics and chemistry.

2. Courses in physics and chemistry, unless radically reconstructed, will continue to serve an even smaller proportion of high school youth, most probably

[2] Phillip Johnson, Unpublished follow-up study (1952) of an earlier study by same author: *The Teaching of Science in the Public Schools.* Bulletin 1950, No. 9 (Washington, D. C., Federal Security Agency—Office of Education).

those with a well-developed interest in a career in the physical sciences. The trend toward developing alternatives to chemistry and physics is obviously in the direction of physical science courses comparable to the present biology course, and also, in some of the larger schools, in the direction of such courses as practical chemistry, electronics, and earth science.

3. The fate of general science as it is presently organized in the four-year senior high school is problematical, although it now attracts a considerable enrollment. It may be expanded and reorganized to take a more important role in the science program than it now does. It is also possible that general science will be replaced or absorbed by a two-year science sequence in the biological and physical science designed to serve the needs and interests of all high school youth.

To summarize the high school situation, it seems certain that the traditional courses in high school science no longer serve the needs of very many youth now enrolled in the high school. Designed to serve the alleged needs of a selected population, these courses seem definitely out of step with existing conditions. A growing awareness of this situation on the part of science teachers and other educators is evident, and progress toward a science program which will interest and challenge all youth is discernible in the literature and in many schools.

SUBJECT MATTER IN SCIENCE EDUCATION

The dissemination of tested knowledge and technique has been and still is a high-ranking objective in science education. The process for selecting particular content for particular situations has become more or less institutionalized and influences the teaching situation through official sources such as texts and courses of study. Widespread preoccupation with standard subject matter is largely responsible for existing confusion with respect to means and ends; "official" subject matter becomes an end in itself. The teaching process, then, tends to exploit children and youth for the sake of knowledge rather than the reverse. Questions regarding what to teach and how to teach it are answered separately in spite of their close relationship. This violation of methodological principles tends to discourage raising the all-important question, What knowledge is of most worth in this particular situation?, and to perpetuate reliance on official subject matter as defined in texts and courses of study.

From the standpoint of modern psychology and a growing concern for the developmental problems of children and youth, many teaching-learning situations in science do not appear to be very promising or effective. Among the inferences and deductions which can be made from a study of modern practices in science education now being worked out in many schools, and from an examination of the many studies pertinent to the problem of selecting science content, the following points seem to be important for what they suggest regarding trends in science education.

1. The established method for selecting content is open to question and critical examination. Reliance on official sources for determining what is to be taught is decreasing, if only slightly, and the selection process is increasingly thought of as an integral part of the teaching-learning situation.

2. Reconstruction of the process of selecting suitable science content involves the development of new criteria

derived from continuous evaluation of the interests and problems of children and youth, and the problems and concerns of the community. Followed far enough, this development should make the selection of content something of vital concern to children and youth.

3. The testing of different approaches to the selection of subject matter is bringing into the school curriculum science content and science experiences formerly neglected if not actually shunned. Abandoning, for example, the nature-study approach to the selection of science content in the elementary school has opened up science experiences and content which were formerly partially or wholly excluded. Cues derived from a study of community problems and from an understanding of the interests, needs, and problems of children and youth have motivated educators to introduce content relevant to many important areas such as human reproduction, family relations, conservation of natural resources, and modern scientific and technological developments.

To summarize, it seems reasonable to predict that the reorientation and reconstruction of the process of deciding what science to teach in a given situation will continue; that the scope of admissible and permissible science content will increase to the point where any established knowledge or technique will be made available to every child or youth as he needs it, when he needs it, and in a way satisfactory to him. Further, it may be predicted that the movement to make available to children and youth a wide range of resources will continue and will include at least the community and the people who live and work in it, a wide range of audio-visual materials, and an even greater variety of written materials than we now have. "Fifty teachers for every classroom" doesn't sound so silly when looked at from this viewpoint. This much seems certain: as we achieve greater flexibility in our ways and means of selecting appropriate science content we will have to become more flexible in our approach to the problem of selecting and providing appropriate educational resources.

SOCIAL IMPLICATIONS OF SCIENCE AND TECHNOLOGY

A third approach to a consideration of trends in science education is to examine some of the most pervasive social consequences of scientific and technologic activity and the extent to which science education in the schools is taking these consequences into account. Let us consider briefly what is meant by social implications or social consequences of science and technology.

No responsible person can deny the central importance of science and technology in our society. In fact, it is not too much to say that the most dynamic phase of our culture is widespread scientific activity. New knowledge and technique, when put to work on a large scale, often have a revolutionary impact on man's ways of doing and thinking. For example, revolutionary social consequences are clearly seen in transportation, communication, and the productive processes. One test of whether or not modern man is obsolete is the extent to which he accepts the revolutionary social consequences which flow from scientific activity and sets about devising ways and means to deal effectively with them.

Social consequences of scientific and technologic advance may be thought of in several ways. A host of advances in technology directly affect our everyday living. Television, the motor car, the radio are good examples. Then there are

those scientific and technologic developments associated with productive processes which often produce marked changes in our work life and in our economic institutions. The coming automatic factory is a brilliant example. A third type of social consequence, perhaps more subtle and more profound than those mentioned above, can be described as marked changes in man's thinking about himself and the universe around him. Evolution is an excellent example of a scientific advance leading to this type of social consequence.

It should be borne in mind that many of the potential revolutionary social consequences of advances in science and technology can be predicted, and at least partial plans made to lessen the shock to people and their institutions.

When we look briefly at what is happening in the schools, with regard to the social consequences of science and technology, it is not difficult to discover that changes occur more slowly here than in science and technology. Schools find it difficult indeed to keep their programs up to date. This is certainly true of the science program, and for easily apparent, if no longer valid, reasons. The rate of making needed changes in the schools need not be as slow as it apparently is. Many educators, including science teachers, are convinced that this is so and that the schools can and should work directly on the problem of increasing public understanding of the nature of scientific and technologic activity and the social consequences which flow from it. Evidence for this statement can be found in many schools and in a now rather voluminous literature which includes not only polemic material but also many serious studies.

To conclude this discussion of the social consequences of advances in science and technology, let me state some of my convictions.

1. A trend in science education in the direction of a more systematic and less superficial study of modern science and technology is under way.

2. It is my conviction that the trend noted above will, indeed must, continue until the systematic study of the nature of science and technology and the social consequences of advances in these areas become a central core in science education from the first through the twelfth grades. Furthermore, the natural and social science programs should merge at this point, and at other appropriate points, and become a central core for the school program as a whole.

3. The school alone cannot do the job indicated above. Means must be found to develop cooperative ways of working with the community, with industry, and with lay people in order to develop and make available the quantity and quality of educational resources needed to build an adequate educational program to deal with modern science and technology.

The great importance of the general problem of developing an adequate teaching-learning methodology for a modern science program should be recognized. Current teaching approaches and methods are not, to put it baldly, up to the job envisioned herein. Implicit in the preceding discussion of trends in science education is the inescapable conclusion that a reconstruction of our whole approach to the problem of "how to teach" must parallel our attempts at reconstructing our approach to the problem of "what to teach." An adequate methodology for science education today must be inclusive and integrative of means and ends, and must at least be compatible with a broad interpretation of the nature of scientific inquiry.

Reorientation in Mathematics Education

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In mathematics, as in other areas of knowledge, shifts of emphasis and of content take place in instruction from one generation to the next. This is as it should be. Discoveries are being made in subject matter and in the way human learning takes place. During the last quarter of a century sufficient changes in mathematics knowledge, in mathematical procedures and applications, and in the explanation of human behavior have occurred to warrant a reappraisal of our program in mathematics education. This evaluation can serve as a guide to reorientation of mathematics instruction in the schools.

An appraisal involves a re-examination of at least three fundamental issues: (1) What is mathematics from a modern point of view? What well-focused and clear-cut concept of mathematics as a subject of instruction should elementary and secondary school teachers possess? (2) How is mathematics learned? How do minds of great or limited ability in the making of abstractions and generalizations come to understand mathematics? Can all students learn mathematics? (3)What purposes does the learning of mathematics serve? Are there different purposes for students preparing for diverse life careers? After clarifying these issues we can proceed to reorientation that will guide us to newer goals in mathematics.

WHAT IS MATHEMATICS?

What is the mathematics that we teach in our schools? It has, in the past, been looked upon as a tool subject. Arithmetic was a tool for carrying out necessary computations. Algebra was a tool for carrying out operations on general numbers. Geometry was a tool for proving relations about figures in space. All this mathematics was a tool for learning the operations to be performed later in trigonometry and calculus. Because mathematics was looked upon solely as a tool, teaching it became a game of drilling in manipulations. Even today in many places—perhaps the majority of places—arithmetic is learned by rote whereby the symbols are manipulated according to rule. There is no effort to show why the manipulations work. Today, algebra is taught almost totally as a tool subject in which meaningless symbols are manipulated to the nth degree. Geometry is to a great extent a task of memorizing proofs of theorems and the necessary concomitant definitions and postulates.

We grant that in part mathematics is a tool subject, but we know that the meaningless manipulation of a tool has little value and no permanence in learning. Some students who made good grades in high school mathematics have difficulty with this subject in college. Because

mathematics skills did not transfer to other problem situations, a number of years ago a new movement took place to teach mathematics as a social and practical instrument instead of a tool. Mathematics was to be learned in real life situations when and where it was needed to solve problems; in other words, incidentally or as isolated bits of procedures and manipulations necessary to solve quantitative problems in other areas of study. This concept is still present (and, unfortunately, accepted) in some core programs.

It did not take very long to discover that mathematics as a myriad of isolated facts to be used in various social situations was utterly unrealistic. Not only was there no transfer of learning but there was no mathematics. Without structure and organization, the limitless facts overwhelm even a superior mind. Social utility is of course a desirable aspect of mathematics, but it is not mathematics.

The failure of both the tool and the social utility concept of mathematics gave rise to a broader way of considering the subject. Mathematics became "a way of thinking," and mathematics concepts became the foundation for our teaching. Thus, $5 + 4$ as a tool is merely 9 and nothing else. As a "way of thinking," $5 + 4$ is a combining of two groups of elements into a single group. Similarly, all the other operations in arithmetic are developed first as concepts through "thinking" about what we do to groups of things. Then we develop symbolic processes to enable us to carry out our thinking in terms of particular groups of these things. These symbolic processes become our facts, our tables, and our computational algorisms. Thus, arithmetic has a why and a how, a concept and a manipulation, a thinking and a doing—*but fundamentally the arithmetic is the totality of related concepts; the way we think about number.* The symbolic processes are the recording and manipulating of our thinking. Mathematics as a way of thinking lies beyond and above the various social situations in which it is used.

Algebra is also a way of thinking about generalized numbers, about variables and functions, and it is the way of thinking that is of vital importance in understanding higher mathematics and applied mathematics. We are moving in this direction in the teaching of high school algebra, but we have taken only the first few steps. In too much of our teaching $3a + 2a$ is still 3 apples and 2 apples (a silly and fallacious idea, since apples are not numbers) and it is not 3 multiplying a number a plus 2 multiplying the same number a. Similarly $(a - b)$ $(a - b)$ has a $+b^2$ in the expanded product with the reason given that "a negative times a negative is a positive"—a reason which has no application whatsoever in this case. We have not given enough consideration to the study of the "why" of algebra, and because we have not we shall continue to have poor educational outcomes. Until algebra becomes a way of thinking—a generalized arithmetic—out of which we develop the usual processes and manipulations for expediting our thinking, little value will result from its study.

Geometry as a way of thinking has fared much better than algebra because of studies by Fawcett, Lazar, Ulmer, Ullsvik, and Gadske in applying geometrical methods to everyday life situations. These investigators were interested in logic as a method of proof, as a means of using evidence to arrive at sound, tenable conclusions. However, some advocates, making the same error that produced the social utility idea in

arithmetic, tried to apply the methods of geometry (which are the methods of any mathematical discipline) to *every* life situation. What was called clear thinking through the study of geometry became befuddled thinking through the rejection of geometry. There is a healthy movement to return to "geometry as a way of thinking about spatial relations." Geometry has a particular structure, with fundamental concepts and logic. The rules of geometry are the tools (very important in using the subject), but the concepts of definition, undefined term, postulate, theorem, given data, conclusion, implication, and deduction are even more important than the rules, for it is a set of proper concepts that enables us to understand what we are doing. Mathematics as "a way of thinking" about numbers, variables, and space promises a more fruitful and more permanent learning experience for students.

Since mathematics as a way of thinking is applicable to varied situations, and acts as a guide for organization of knowledge in other fields, it must possess a structure that makes it independent of the situation or of other knowledge. "Mathematics is both queen and servant of the sciences." To serve in both capacities it must be learned as a well-organized hierarchy of concepts, relations, and operations; that is, as a self-contained structure. This we are coming to see more plainly: It is the thorough understanding of this structure that permits its correct application in solving our quantitative problems. It is this structure, also, that makes it the main agent for communicating scientific thought, one of the most necessary functions of modern society.

In any reorientation of teaching we must keep this communication aspect of learning in the fore. A number of characteristics of mathematics as a communicating agency are fundamental. In the first place, mathematics deals with propositions—assertions and implications—*which can be verified* and *on which any two rational people can agree*. There is no room for disagreement within the structure of our elementary and secondary mathematics. Thus the implication "If two positive numbers, both greater than one, are multiplied, then the product is greater than any of the two given numbers" is a proposition which can be proved and on which all reasoning people will agree. These mathematical implications are not learned in social or vocational situations. They are instigated in such situations, but they are learned in the separate study of mathematics as a structure of concepts and operations.

In the second place, mathematics is *independent of changes in time and in space*. What we learn in mathematics today will have the same validity ten, a hundred, or a thousand years from now. Mathematical knowledge is enduring. This does not mean that new theorems, new ideas, and *new mathematics*—all more forceful than existing mathematics—will not be discovered, for they are being brought into existence daily. But these new systems are likewise independent of time and of space. Mathematics is indestructible. This property makes mathematics an enduring communicating agent that is superior to any other area of knowledge. This aspect of mathematics cannot possibly be learned in social situations, for such situations change radically in time and in space. This aspect can be learned only in the study of ancient and modern geometry, in the study of algebra as ever-generalized arithmetic, in the study of ancient and modern trigonometry; in fact, only in the study of mathematics itself.

In the third place, mathematics is *exact in what it does,* although it frequently treats inexact data. All measures of manufactured products are approximate. Measurements based on a small sample of a large production, however, with all the errors involved, suffices, through treatment by exact mathematical theory, to set up a prediction about the quality of the entire production. These predictions are made in terms of probabilities that are communicated in the form of ratios and confidence limits which can be interpreted in an exact manner by those who know and understand the symbols and the concepts involved. The mathematical statistical methods are exact, but the data treated are inexact. The results are communicated by exact methods. The mathematics involved may be instigated in practical industrial situations but it is not learned there. It is learned in the separate analysis of quantitative situations devoid of particular concrete implication. It is learned in a separate study of mathematics which is checked for its validity in future practical situations.

Finally, mathematics is *rigorously logical.* It deals ultimately with purely deductive systems. The discoveries and creations of relationships of number, space, and elements devoid of concrete designation, come initially from sensory experience; that is, experience with and inductive reasoning about physical objects. In school mathematics, unfortunately, heretofore the inductive generalization and derived rules are frequently all that is learned, and in a strictly scientific sense this is not mathematics. The subjugation of all this sensory experience to discrimination, abstraction, generalization, and the acceptance of certain stated generalizations as postulates; the stripping of generalizations of all physical significance and thereby making the objects of our thought merely abstract creatures; and the subjection of these generalizations and abstract entities to purely deductive methods will result in building a mathematical system. The application of this system enables us to describe our environment—the world that lies around us.

Because of these four properties—rational agreement, independence of changes in time and space, exact methods, and logical deductions—mathematics has come to enjoy great respect. Mathematics is the one area of human enterprise where the motivation to deceive has been practically eliminated. Not because mathematicians are necessarily virtuous people, but because the nature of mathematical ability is such that deception can be immediately determined by other mathematicians. This requirement of honesty soon affects the character of the continuous student of mathematics. So a mathematical result is believed when it is used in communication. This result is, or can be, immediately checked by all other persons who hear or see it and have ability in mathematics.

HOW DO WE LEARN MATHEMATICS?

A professional teacher is much concerned with the psychology of human learning. He seeks to answer the question, How does the human mind come to know mathematics as a "way of thinking," as "a medium for communication," as "a procedure for quantification of problems," and as "a description of observed phenomena"? In large measure, answers to these questions are supplied in the Twenty-first Yearbook of the National Council of Teachers of Mathematics, entitled *The Learning of Mathematics, Its Theory and Practice.*

In the present discussion it must suffice to describe a few of the high points of what is coming to be an accepted theory of learning.

Learning always has its beginning in some concrete situation in which the student is confronted with a quantitative problem. He is given experience involving spatial or numerical aspects and from these experiences he is guided into making generalizations that form concepts. He first learns his mathematics as a way of thinking, not as a set of skills. For example, in arithmetic he develops a concept of division by having many experiences of dividing a group of objects into a given number of smaller equal groups (or into groups of a certain size). Only after he recognizes this as division does he take up the symbolization of this thinking, and then the actual recording and memorizing of division facts. In algebra he develops the concept of coefficient by generalizing multiplication in which the multiplicand is always the same. That is, he thinks through 3×2 is $2 + 2 + 2$; 3×8 is $8 + 8 + 8$; $3b$ is $b + b + b$, and so on until he understands ab is $b + b + b + \ldots$ to a addends. Only then does he need to be given the name "coefficient." In geometry he develops the concept of a postulational system through prolonged experience with small sets of data from which he derives conclusions; by using simple premises to draw conclusions; by interchanging definitions with theorems and deriving the same set of relations as established previously, coming eventually to recognize the arbitrary character of postulates and the relevancy of truth in a mathematical system. In general, the concept, the way of thinking, is developed first, not the mature deductive system which is the end product of mathematics learning.

Once a concept has been established we practice thinking with the concept. We "think" addition of 8 and 6 as $8 + 2$ are 10 and 4 more are 14. We "think" many other such additions in terms of "so much more make a ten and so many more ones." Then we symbolize our thinking into $8 + 6 = 14$. Similarly we think of adding 27 and 38 as adding 2 tens and 3 tens, and 7 ones and 8 ones, and then combining the two results. We practice this type of thinking and finally symbolize it in the mature computational processes that become the tools with which we fashion our future thinking with these concepts. Then we practice or drill with the tools until they are efficient devices under our conceptual and manipulatory control.

To illustrate from algebra, we manufacture experiences in which it is necessary to multiply, divide, find powers and roots of large numbers, all of which can be expressed as powers of 2 or 3. From this experience we develop the concept of using exponents of a single base as an expedient way of performing mathematical operations on large numbers. We practice thinking on this concept which leads to the desirability of having one base which will express every number by supplying the proper exponent. These exponents become a special class of exponents which we give a special name—logarithms. Thus, logarithms are exponents, and since the concepts under which exponents operate are already known, the same concepts apply to logarithms. Then we sharpen these concepts for logarithms, symbolize these concepts in terms of logarithmic notation, and develop the manipulations necessary for the use of the tables of logarithms. We practice handling the conceptual or relational aspects of logarithms as well as the computational aspects. Note that the tool

or manipulatory aspect, the mechanical, is last in our order of thinking. A manipulation based on a correct concept can be recalled or relearned. A rote manipulation is easily lost forever.

This learning process of going from experience with things, to thinking about things, to abstraction and concept formation, to thinking with the concept, to symbolization and manipulation, and finally to reorganizing the newly learned concept into the whole structure is, in the field of mathematics, the one that has the most promise of permanence of learning and of transfer of learning to the solution of quantitative problems. The building of concepts is so necessary if we are to develop mathematics as a way of thinking that will serve us in our various life careers. It is based on our appraisal of what mathematics is, and the recognition that a "how" without a "why" is for the most part temporary and a useless game when one considers the purposes that the learning of mathematics should serve.

PURPOSES OF THE LEARNING OF MATHEMATICS

There are at least four fundamental purposes that the study of mathematics should attain. First, it should serve as a functional tool in solving our individual everyday problems. The questions How much? How many? What form or shape? and Can you prove it? arise every day in the lives of every citizen. People who can answer these questions with ease and accuracy are happy. Those who cannot, make serious blunders and are frequently unhappy. To many people, effective citizenship and democratic action seem far removed from the effective use of basic mathematical concepts and skills. But if an effective citizen is one who earns his own living, rears and supports a family, buys and maintains his own house as a home, protects his family by adequate insurance, protects his job or career by proper investments, protects his old age by savings and annuities, figures and pays all his taxes honestly, with due regard to every allowable deduction, estimates and budgets his income, keeps himself informed of government finance and statistical surveys of the nation's economy, reads and interprets the business and financial section of the daily newspaper, serves in the armed forces or in the various areas for protection and preservation of our way of life, and makes thoughtful deductive analyses of a quantitative situation the predecessor and guide for his actions, then certainly efficient use of mathematics skills and concepts is very basic to democratic citizenship. It is in these life situations, or simulated situations, that the learning of mathematics is first motivated.

In the second place, mathematics serves as a handmaiden for the explanation of the quantitative situations in other subjects, such as economics, physics, navigation, finance, biology, and even the arts. The mathematics used in these areas of practice is exactly the same mathematics and involves the same mathematical concepts and skills. It is only the things to which the mathematics is applied that are different, and this is immaterial if one really understands the mathematics. This service of mathematics is exceedingly important to future scientists, engineers, technologists, technicians, and skilled mechanics. It is a vocational or career service that is of value to large numbers of our present students.

In the third place, mathematics, when properly conceived, becomes a model for thinking, for developing scientific structure, for drawing conclusions, and for

solving problems. Its postulational nature, that is, accepted relations (axioms or postulates), undefined terms, definitions, theorems, and a logic, aids all other areas of knowledge to approach scientific perfection. This same structure aids us in problem-solving methods in which we collect, organize, and analyze data, and deduce conclusions for future action. For example, one who understands the mathematical method can easily frame the problem, Which is the better financially, to borrow $400 from the bank at 4% for a period of one month, or take it from my savings account paying 2%, whereby I lose the interest on the $400 for six months? into a chain of syllogisms that leads to the correct response.

In the fourth place, mathematics is the best describer of the universe about us. In an age that has become statistical and scientific in much of its human endeavor, the need for people to understand these phenomena is not only a cultural necessity but to some extent a necessity for intelligent action. If the mathematics of international banking cannot in some way be made understandable to the layman, how can he determine his position in voting on such matters? If the forces of nuclear fission cannot be made quantitatively significant, how can the nonscientist determine his reactions to it other than to dread it? Mathematics communicates quantitative aspects of our society and our world in such simple statements as "the bacteria grow at a rate proportional to the number of them present," and in such a simple symbolic relation as $E = mc^2$. A knowledge of mathematics enables the layman to interpret the statements. We need to refer again and again and translate into action the statement in the 1923 report on *The Reorganization of Mathematics in Secondary Education*, which reads:

> The primary purposes of the teaching of mathematics should be to develop those powers of understanding and of analyzing relations of quantity and of space which are necessary to an insight into and a control over our environment, and to an appreciation of the progress of civilization in its various aspects; and to develop those habits of thought and of action which will make those powers effective in the life of the individual.

SOME NEW HORIZONS

The preceding discussion gives indication of a reorientation in mathematics education. Changes are now appearing in both teaching procedures and subject matter content that promise a richer and more enduring learning experience. The more important of these emerging practices seem to be the following:

1. *Learning and thinking* are synonymous and primary. The classroom is becoming a laboratory in which we work with concepts. The class is practicing thinking much more than drilling on skills. All learning is looked upon as problem solving. Thus, finding 15% of 80 is now a *problem*, and a pupil does as much thinking in analyzing what is meant by and how to achieve the answer to this statement as he would to the question, How much do I save if I buy an article priced at $80 at a 15% discount? Similarly, in algebra he uses the graph of an equation to discover what it means to solve an equation. More emphasis is put on what is a root of an equation than on the mechanical solution of an equation. The mechanics are not neglected, but they are the end by-product, and not the main goal of learning. We are teaching students to learn how to learn mathematics.

2. *Statistical reasoning* is fast becoming an integral part of the common activities of man. It enters into the understand-

ing and the explanation of problems in safety, genetics, longevity, human variability, cost of living, occupational choice, income distribution, advertising, age distribution, change in family size, testing, measuring, public opinion on public affairs, games of chance, sports, consumer preferences, scientific investigations, conservation, and many other areas that affect each one of us. For the interpretation of these areas there is not so much a need for the numerical computation of statistics such as the mean, median, mode, correlation, or variance as there is for knowing what these concepts imply. It is in the correct interpretation of presented statistics that the layman can take intelligent action.

The two important aspects of statistics for the citizen are: (1) in a distribution of attributes arising from chance causes there is a coexistence of stability (a central tendency) accompanied by a variation; and (2) by proper sampling, both the stability and the variation of the whole population can be predicted to a high degree of probability. Since the solution of group problems in a democratic society demands mass participation, and since the processes of solution often entail the use of statistical reasoning, the participation is possible only if large numbers of people are prepared to make the statistical approach. The mathematics classrooms are beginning to meet this challenge. Students are collecting, organizing, and analyzing statistical data. They are applying mathematical methods to the concepts of stability, variability, and sampling. For example, if the weights of all fourteen-year-old boys in a school are plotted in a distribution, and the average weight is 124 pounds with a standard deviation of 7 pounds, is a boy weighing 138 pounds overweight? A correct concept of variability in chance causes will indicate to future parents that *overweight* for an individual is a phenomenon that has nothing to do with the average weight of all individuals. When all facts are considered, the boy may actually be underweight. Parents who insist that their children who are under the average weight for their age should gorge themselves with fat-producing foods are in dire need of mathematical statistical reasoning.

3. *Laboratory procedures* in which physical objects are counted, measured, subjected to transformations, and built to scale are being employed in the modern classroom. All mathematics learning can ultimately be traced back to some sensory experience, even though at times the chain may be long and nebulous. Recognizing this, the arithmetic classroom has representative materials for developing concepts—abaci, discs on magnetized boards, flannel boards, circles divided into fractional parts, and many other visual-tactile aids. The geometry classroom has adjustable triangles, quadrilaterals, regular and semi-regular solids, all of which can be investigated by measuring devices to discover relationships which are later proved deductively. More and more the need for films that can display the dynamic aspects of continuity and limits is being sensed. Mathematics is not a laboratory subject, it is a deductive abstract science. But its initial learning begins with things. The classrooms in mathematics are being equipped with things, and the teacher's great task is to advance the pupil from using sensory things to thinking in abstract symbols.

4. *The non-academic learner* has never fared well in his mathematics learning. The work in the classroom from the first grade on was usually geared to the better students. So the below normal and slow learner never did learn, and came to high

school not knowing, even the fundamentals of arithmetic. A dual education program in high school mathematics is fast appearing. The courses are being adapted to the learner, and not the learner to prescribed courses impossible of his attainment. In the high school we are learning to reteach meaningful arithmetic, the type so urgently needed in citizenship and vocational life, to those who need it most. In the senior high school a course in consumer mathematics is beginning to meet the needs of young women and men who will within a short time be mothers and fathers, soldiers and workers, and voting citizens.

5. *The mathematically gifted child* has been one of the most neglected in the past twenty years, when the great influx of all youth of high school age caused a lowering of academic requirements for all high school graduates. The growing scarcity of scientific, engineering, and mathematics personnel in the United States has instigated a search for these people, and with the search an attempt to provide an adequate educational program for them. In the professional literature, programs are now being proposed for these students, and in the near future we can see them doing all the usual first two years of collegiate mathematics before they complete their high school term. They, by their very ability, will deal more with pure mathematics, in abstractions, and will need little of sensory experience to guide them.

6. *Historical approaches* to learning mathematics have been rarely used in school classes. Yet the growth of mankind is largely reflected in the growth and development of mathematical concepts. Since a concept is not just one thing, but an ever-growing, deepening, widening phenomenon, a student can learn to discover, learn to create, by studying the discovery and creation of the present concepts taught in school mathematics. To study number as the Babylonians, the Egyptians, the Greeks, the Romans, the Arabs, and finally the modern western world came to conceive of number is to build a real understanding of modern arithmetic. To study algebra from the rhetorical stage through the syncopated stage that was used by Diophantus to the modern symbolic stage is to develop a deeper concept of symbolic thinking. To study Euclid's geometry, then analytic geometry, is to develop an appreciation of the power of algebraic methods for the solution of space problems. Not all concepts in mathematics should be treated historically. But as an indestructible yet growing instrument for interpreting our modern world, mathematics is being taught by teachers today more and more through its historical development.

7. *Mathematics contributes to the general education* of man. No subject-matter area in school and college education can detach itself from its effect on and relation to the life of man. Mathematics was, and perhaps at places still is, taught for its own sake, as a great, venerable organized area of human knowledge. Today we know that all learning affects the individual as a person. So the teaching of mathematics is becoming concerned with *values*. In particular it recognizes the value of an *informed citizen* and presents important quantitative information for the learner. It desires to produce a thoughtful citizen and so changes its techniques to promote development of ways of thinking, of problem solving, of the understanding and ability to formulate problems, collect pertinent data, make estimations, do functional thinking, understand operations, the nature of proof, and use of symbolism.

Mathematics teaching recognizes the need of developing *working citizens*. So it attempts to create for every individual a working tool backed up by a set of concepts that will enable a person to do the mathematics of the home, the shop, the laboratory, and business. It recognizes the need of mathematics in the study of other subjects and it coordinates its development wherever possible. But we need more than working citizens; we need *cultured citizens*. So our teaching attempts to show the place of mathematics in the history of mankind, its great human achievement, and its effect upon cultural change. We also recognize the value of a *humane citizen*. Toward this end, mathematics teaching takes great pains to show the relativeness of its assertions, the limitations of the human mind, and that mathematics is only one of man's many feeble efforts to explain his own universe.

But above all we recognize the need for developing a continuously *maturing mind and personality*. We believe this personality is developed through behavioral changes that take place in learning. Mathematics teachers today are concerned with attitudes, with ethical values derived through meeting success in the study of mathematics, and with the recognition of the dignity of each individual student. It is significant that whereas fifteen to thirty years ago mathematics education emphasized that in a physical universe which is explained in part by mathematics, the child must learn this mathematics, today it recognizes that a child is born into a society in which he comes to feel a need for certain quantifications to explain the universe that unfolds before him. The shift in order from universe → mathematics → child, to child → mathematics → universe is highly significant of the reorientation that is taking place in mathematics education.

Cooperative Planning for Professional Education of Teachers

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CURRICULUM development at Northern Illinois State Teachers College is a continuous process. A curriculum committee coordinates the planning of the total college curriculum and concerns itself especially with the offerings in general education. Each department is responsible for the improvement of its own courses.

The Education Department has for some time been aware of the need for an integration of theory and practice in the professional education of teachers. It recognizes the desirability of direct experiences at all stages of professional preparation and is making efforts to provide such experiences.

One result of these efforts is a series of courses commonly called block or experimental programs. The term "block" means that these programs are usually a combination of two or more regular courses and are scheduled to meet for a block of time each day. They are experimental only in the sense that they represent a variation in the regular program and are subject to frequent evaluation and change.

The block programs as now offered provide a definite sequence of experiences. The first of the series is a twelve-quarter hour block (equal in credit to eight semester hours) offered during the sophomore year. This program consists of a study of human growth and learning accompanied by planned experiences with children and youth.

During the junior year a full quarter of professional work is offered as the second block program. The emphasis is on elementary-school teaching and curriculum. In addition to the classroom hours, the student is assigned to a school for further laboratory experience under the guidance of the college instructor. A similar professional quarter in the secondary curriculum includes a half day of student teaching, together with a study of the secondary curriculum, educational psychology, and measurement.

The final professional block is designed to help the student meet individual needs revealed during student teaching and to unify his total experience in teacher education. The development of a personal philosophy of education based upon considered beliefs concerning the nature of society, the purpose of the school, and the way the child grows and learns is a primary focus of the course. The other major emphasis is on developing a valid conception of the

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teacher as a mature person, a responsible citizen, and a member of the profession. Laboratory experiences are planned for each student as a part of the instructional program. The course carries eight quarter hours of credit and is open only to seniors who have completed their student-teaching requirements.

SOPHOMORE-BLOCK PROGRAM

The first of the experimental programs was originally planned in 1948 and is known as the sophomore block. As first set up by a committee of laboratory school teachers and members of the Education Department this program included course work in child development and elementary methods and gave four quarter hours of credit in student teaching. After the first year it was decided to discontinue giving student-teaching credit, but to offer planned laboratory experiences as a part of the program. During the next several years, therefore, the block came to include a study of child development and learning closely integrated with observation and participation experiences in the elementary school.

The block program proved to be popular with students, and each year increasing numbers of sophomores registered for the course. The members of the education staff gave considerable thought to the function of the sophomore block as they considered a fundamental revision of the program of professional education for elementary teachers. In the spring of 1952 they decided that during the next academic year a definite attempt would be made to assess the contribution of the sophomore block to the total program. The results of this evaluation were expected to provide some basis for deciding whether such a program should be made a required experience for all students in the elementary curriculum.

COOPERATIVE PREPLANNING

During the summer eight members of the Education Department met to plan for the following year. Four sections of the sophomore block were scheduled, two for the autumn and two for the winter quarter. They were to be taught by four different instructors, only one of whom had previously worked in the sophomore block. All of the group, however, regularly taught courses in child development, adolescent psychology, or educational psychology.

The first task of the group was to consider the kinds of experiences which might best be offered at the sophomore level as an introduction to professional education. The members agreed that they would continue to operate within a twelve-quarter hour block of time; that there should be an integration of classwork and direct experiences with children and youth; and that the general area of human growth and learning should be the focus of the program. With these basic guides in mind, they proceeded to redefine the purposes which the sophomore block should serve. They were:

1. Understanding of the pattern, sequence, and variations of human growth and development.

2. Understanding of the process of human learning, including motivation, memory, reasoning, generalization, and concept development.

3. Development of skills in using common techniques of child study, such as anecdotal records, time studies, and individual child study reports.

4. Development of skills in observing, communicating, and working with children of different ages, both in and out of school.

5. Development of positive attitudes

toward the problems of growing up, deviant behavior, the range of the normal, and so on.

The planning group also suggested experiences through which these objectives might be achieved. They decided that there should be eight to ten hours of classwork and a minimum of ten hours of direct experience each week. The laboratory experiences were to be planned to include some work with children in out-of-school situations. In addition, each student was to be assigned to an elementary-school classroom to observe pupil behavior and to participate in the ongoing activities of the room. Where possible it was considered desirable to give the student an opportunity to work at several levels of the elementary school in order to achieve a wider understanding of different age groups. The college instructors working with the block program assumed the responsibility of maintaining close contact with their students by observing in the school during the time the students were participating there. In this way, it was felt, a functional unification of the direct and vicarious aspects of the programs could be maintained.

Ways of evaluating progress toward stated objectives were considered by the planning group. Tentative plans were made for gathering evidence by means of student logs, evaluations by supervising teachers, cooperatively developed tests of mastery of content, and situation tests to evaluate attitudes and insights. Individual conferences and cooperative evaluation of progress by the student and the instructor were also suggested.

With this general preplanning by the group as a guide, the two staff members who were responsible for the block programs during the autumn quarter proceeded to work out specific activities and experiences for their groups of students. Both classes met for a two-hour period from ten to twelve o'clock each day, an arrangement which permitted some joint activities and common experiences such as movies, trips, and use of resource persons. One class worked in the laboratory school from eight to ten each day and the other participated in the program of one of the city schools during the afternoon.

The two instructors planned together and spent approximately equal amounts of time on the various aspects of course content but did not attempt to subject themselves to any rigid uniformity with respect to teaching methods or specific activities. However, they did build a list of basic concepts which they planned to develop, and suggested a series of activities they believed would contribute toward the elaboration of each concept. This list of concepts is useful as a guide for further work by subsequent instructors and as a basis for a future statement of the contributions of the block to the total program of professional education.

COURSE ACTIVITIES

The physical development of children was the first area to be taken up in the course because variations in size and weight are most easily observed by inexperienced students. Direct experiences included participation in weighing and measuring children in the schools, the use and interpretation of the Wetzel grid, observation in speech-correction and sight-saving classes and in a physical therapy center, an all-day trip to a new elementary school to see the most modern provisions for healthful living in the classroom, and the recording of many observations concerning the characteristics of physical and motor development at various ages. The need for sex educa-

tion and the responsibilities of the school in this area were considered. The films Human Growth, Human Beginnings, and Human Reproduction served to focus the discussion and to provide a basis for consideration of desirable practices.

Social, emotional, and mental development were similarly considered, with special attention to their interrelationships. The daily contact with children served to center attention on the whole child as a product of all the forces acting upon him. Attendance at PTA meetings, contacts with parents, and the study of school records made the concept of the multiple causation of behavior a matter of direct experience rather than merely an academic principle.

As students became more skilled in their contacts with children they participated in many ways in the ongoing activities of the classroom. They taught and supervised games during recess or physical education periods, they worked with small groups in various situations, and they helped individual children who had special difficulties. These activities led naturally into a study of the learning process. Discussions of motivation, reasoning, and concept formation were liberally illustrated by a variety of firsthand experiences in the classroom.

The development of skills in techniques of studying children was an important part of course activities. Thoughtful and objective observations were recorded by means of anecdotal records of pupils' behavior. Time studies of selected individuals provided new insights into study habits and motivation. A comprehensive child-study report consisting of a summary of background information, a record of continued observation and contact, and implications for guidance served to integrate various study skills in a purposeful project.

Coordination of class discussions and projects with the participation activities was a constant consideration. The college instructor spent much time visiting in the various classrooms and in informal conferences with the cooperating teachers in the schools. Weekly newsletters informed the cooperating teachers concerning the activities of the class, and special activities which would prove helpful to the students were sometimes suggested. Arrangements were also made for some of the cooperating teachers to visit and participate in the class discussions. These visits provided an opportunity for the cooperating teachers to become better acquainted with the content and method of the class sessions.

EVALUATING THE PROGRAM

During the autumn quarter, when the reorganized sophomore block was taught for the first time, the planning group maintained contact and interest through an occasional meeting and many informal discussions with the instructors. They continued to plan actively, however, for the evaluation of the course. Particular attention was given to the problem of evaluating the information and understandings in human development and learning.

Each member of the planning group contributed test items which he had used in his own classes. These items were compiled and copies of the total list were distributed to the members of the group for two kinds of judgments. If the item seemed a good one, the staff member checked the response which he believed to be correct. If the item seemed insignificant or poorly constructed, he so indicated. The final test was composed of items which all or most of the group believed to be acceptable and on which they agreed as to the correct response.

Three separate courses in the regular college curriculum deal with material on human growth and learning. Therefore, it was decided to place in separate groups items relating to child development, adolescent psychology, and educational psychology. The completed test had about one hundred fifty items, unequally distributed among the three areas.

The whole test was given to the two divisions of the sophomore block. The median achievement was almost the same for the two groups but one class showed slightly superior achievement in educational psychology, while the other scored somewhat higher in adolescent psychology. There is some reason for believing that, in spite of the close cooperation and planning of the two instructors involved, the test results reflect an emphasis that each gave to an area in which he had a superior background or a special interest.

The sections of the test dealing with child development and with adolescent development were also given to students in two classes who were studying the material as separate subjects. In neither case was the achievement of these classes superior to that of the sophomore-block students. No separate class in educational psychology was available for a comparison in that area.

These results, although far from conclusive, suggest that the sophomore-block students are not inferior to those registered in the regular courses in a knowledge of the subject matter ordinarily considered important. This observation can be made in spite of the fact that the actual class time spent in any one area by the block-program students is considerably less than that available to students in regular courses. In the light of present knowledge of human learning it seems reasonable to suppose that the meaning given to the material by the direct experiences included in the block program may have influenced this result.

The same test was given at the beginning of the winter quarter to six groups of students, including two new sections of the sophomore block and students registered in courses in child development, adolescent psychology, and educational psychology. There was no significant difference in achievement between students in the block programs and those in the regular courses. This result provided some evidence that the achievement of the block program students was due to learning while in the course rather than to superior initial competence.

Attempts to construct objective situation-type tests to get at attitudes and ability to apply principles have thus far been unsuccessful. The chief value of the work done on testing up to this point has probably been not in the results obtained but in what the group has been able to learn from its experience.

The objective test was one indication of the increase of the students' understanding of human growth and learning. Other types of evidence were far more important and revealing. Logs of daily happenings were kept by each student during most of the twelve weeks. An analysis of the contents revealed a constantly increasing ability to interpret behavior in the light of possible causes and to apply concepts and principles in actual situations. An excerpt from a student's log illustrates this point.

> Mrs. S. was called from the room and the children became very noisy. I saw no need for hushing them because they would only continue to make noise a few minutes later because they had nothing to do. I walked to the front of the room, com-

mented on a few of the posters that hung there and then talked to the children in a soft voice. Some of the children began to hush the others. I continued to talk and in no time at all the children were quiet and listening.

I have seen teachers pound the desk for order. I have heard them say, "Now, let's be nice and quiet," for one reason or another. But today I learned that if you can interest children you can have their attention without even demanding it. It was a most satisfying experience.

Increasing skill in record keeping was also evident as students attempted to state objectively what they saw and to interpret their observations. Two anecdotes written by the same student about four weeks apart provide evidence of this growth.

September 29. Jerry always seems so slow and lazy in all that he does. I don't think it is overexertion or fatigue that causes it because I was told that he has a brother who is the same way. It must be an inherited factor.

October 26. Setting: Play period, playing Long Base.

Incident: Larry, one of the larger third graders, hit anyone who had the ball when he wanted it. Ronnie, the smallest second grader, picked the ball up once and Larry hit him in the stomach. I asked Larry if he didn't think he should apologize to Ronnie. He went over and gave Ronnie a pat on the back and ran right back to the game. When the children lined up to go in I noticed Larry had his arm around Ronnie.

Interpretation: It could be that Larry had been angry with someone earlier in the day and he was expressing his anger by hitting the other children. Larry is one of the bigger boys in the room and he is quite well-skilled in handling a ball and it is possible that he becomes impatient with the more unskilled children.

Continued observation and evaluation of the students' skill in working with children furnished further evidence of progress. The college instructor and the cooperating teacher conferred frequently concerning the students' growth, and at the end of the quarter they worked out together an evaluation sheet on which evidence of achievement was recorded in answer to such questions as these:

Does the student enjoy working and playing with children?

What evidence does the student give of understanding the causes of children's behavior?

What evidence of growth in ability to work effectively with children have you seen?

Has the student shown a sense of professional responsibility in such things as being on time, sending word concerning unavoidable absence, and respecting the confidential nature of school records?

Is the student dependable? Can he be counted on to fulfill his obligations on time?

All things considered, does this student show adequate promise of becoming a good teacher?

The items on the evaluation sheet were also used by the cooperating teacher and the college instructor in informal conferences with the student. Students were encouraged to contribute evidence which would indicate their own progress in each area.

When the material from all sources—the objective tests, the professional logs, the various records of children's behavior, the cooperating teacher's evaluation, and the day by day contacts of the college instructor in the school situation—was brought together, there seemed to be ample ground for believing that the experiences which the students had in the sophomore block made a significant contribution toward the achievement of the objectives which had been set up for the course. However, like many attempts to evaluate progress more carefully, this

one raised more questions than it answered. Far from feeling that they have succeeded in setting up the best possible program for developing insights into the area of human growth and learning, the planning group are now more than ever aware of the need for further study and experimentation. They are convinced that some sort of block program combining direct experiences and class activities offers the greatest possibilities for a successful organization of experiences at the sophomore level. They have also identified a number of areas in which they need more study and additional information.

PLANS FOR THE FUTURE

There is a need for further objective evidence of ability to apply principles and use concepts as well as to recognize or recall facts. The present objective test is deficient in this respect. Can one be developed which will supply the needed information?

The proportion of time which may most profitably be spent in direct participation and in observation or class discussion activities needs further study. At present there is some reason to believe that a flexible schedule which would allow varying amounts of time for different activities at successive stages of the work would be advantageous. Can a plan be devised to test the validity of this hunch?

The lack of variety of direct experiences is also a matter of concern. As a first experience in studying children, should not many different experiences in home, play, club, and other recreational activities be offered rather than so large a concentration on the study of the child in the school situation?

The long-range effects of the program need to be explored. How does the participation in the sophomore-block program affect the skills and attitudes exhibited in later professional work, especially in student teaching?

These and other problems are now being considered by the planning group as they continue their work. Four members of the group have taught the sophomore block and the others have planned and followed closely the progress of the course. This experience will be valuable in helping the group to devise more effective means for gathering reliable evidence of progress. Though they may never arrive at conclusions which they can consider as final, a continuation of their present way of working will result in the collection of evidence concerning increasingly important questions. It will also result, as they act on that evidence, in a constantly improving program of professional education for teachers.

A New Program for Nursing in Community Colleges

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THE Cooperative Research Project in Junior and Community College Education for Nursing has as its primary purpose the developing of a new type of program for the preparation of nurses. Interest in experimentation in programs of nursing in colleges offering two-year semiprofessional curricula stems from the need for a more effective and more economical system of education for nursing and from the rapid development of community colleges. The existing system of education for nursing is almost entirely outside the general system of education of this country. The programs preparing for nursing are predominantly of the apprenticeship type. Almost 90 per cent of all programs in nursing are conducted by hospitals and are directed primarily toward the needs of the hospital for nursing service.

In a search for a more desirable design for the preparation of nurses, the Division of Nursing Education of Teachers College has been studying for some time the educational patterns which have proved effective in other fields. It has also been interested in exploring the functions of nursing, and study in this area continues. In 1952 the Division of Nursing Education received an anonymous grant of $110,000 to be used over a five-year period in experimentation with a new type of educational program in junior and community colleges. This grant provides for a program of cooperative research with a number of carefully selected colleges.

ASSUMPTIONS

Certain basic assumptions underlie the evaluation of the proposed new type of program in preparation for nursing. First, it is assumed possible and desirable to differentiate the functions of nursing. McManus[1] states that the functions of nursing can be regarded as on a continuum or as having a spectrum-like range. This is in contrast with the general belief that all nursing functions fall into a single category—the professional. Actually, there are three discernible categories of functions within the occupation of nursing. Certain functions have professional characteristics and require a professional type of education. Others demand very little training and might, conceivably, be learned on the job. Between these two extremes is a considerable number of nursing functions of the technical or semiprofessional type.

[1] Division of Nursing Education, Teachers College, Columbia University. *Regional Planning for Nursing and Nursing Education.* Report of a Work Conference (New York, Bureau of Publications, Teachers College, Columbia University, 1950), p. 54.

Therefore, the largest number of workers is needed to carry out these functions.

A second assumption is that educational programs can and should be devised to prepare for each of these categories of functions. The programs preparing for the technical type of functions can be most effectively carried on in junior and community colleges which have similar programs for other fields. The emphasis on the technical or semiprofessional type of program within this project does not in any way minimize the need for study of the preparation for the other two categories of functions. Indeed, if the problem of supplying adequate nursing care to the American people is to be solved, programs preparing for all kinds of nursing functions will need careful study.

The third assumption is that, if the functions of nursing can be differentiated and if programs preparing for these functions can be devised, the workers will need to have some plan of working together. The nursing team is, according to the results of various studies, the most effective way to use workers with different functions and, consequently, different preparation.

It is also assumed that the experimental programs can prepare the worker within a two-year period to perform technical or semiprofessional functions. Upon graduation it is assumed the worker is prepared for beginning practitioner positions and prepared to become competent rather than being fully competent.

The final assumption is that these programs are planned to conclude the formal educational preparation of the worker, with the exception that with individual qualifications a few students would be eligible for education in nursing at the upper divisional level.

GENERAL PLANS FOR THE PROJECT

The Cooperative Research Project in Junior and Community College Education for Nursing provides for the selection of a number of junior or community colleges which are willing and able to undertake a new type of program in preparation for nursing. The colleges selected will include both those publicly supported and those privately supported, and will be located in various sections of the country. The essential criteria for selection are eagerness on the part of the administration and faculty to develop the new type of program and willingness and preparedness to share in the cooperative aspects of the research.

A small research staff has been appointed to develop and carry on the project and to serve as consultants to the faculties of the cooperating colleges. The staff includes those whose major interest and preparation are in the field of education for nursing and those who are expert in the junior and community college field. The research staff may be supplemented as the need arises to provide special services or consultation to the cooperating colleges. Work conferences and other types of group meetings are planned for those participating in the project.

An advisory committee has been organized to review plans and purposes, help establish criteria for the selection of cooperating colleges, and give counsel as the project develops. This committee of sixteen members includes representatives from junior colleges, nursing education, allied professional groups, and the consumers of nursing. In addition to representing a variety of interests, the committee members represent different sections of the country.

The committee meets at least once annually. Provision has been made for a subcommittee to meet more frequently if the research staff deems it necessary. Dr. Henry Littlefield, vice president of the University of Bridgeport, is chairman of the advisory committee. The advisory committee has met twice: in March 1952 and January 1953.

Evaluation of the new type of educational program is one of the major concerns of those cooperating in the project and is being carried on concurrently with the development of the programs. Results will be summarized and reported as the study progresses, and a detailed summary will be made at the end of the five-year period provided for in the grant. It is expected that the findings of the research done will indicate whether or not this kind of program in preparation for nursing can and should be offered in other junior and community colleges throughout the country.

CHARACTERISTICS OF PROPOSED PROGRAM

The program proposed for the colleges cooperating in the project would differ in several respects from the nursing programs now in existence. Some of these characteristics are:

1. The program will be college centered and college controlled. The faculty of the college will be responsible for planning all aspects of the program and for all teaching within the curriculum. It will be an integral part of the total college program.

2. It will be a two-year curriculum in nursing combining both general education and technical training. General education will account for about one-third of the total curriculum and nursing for about two-thirds of the curriculum. Students in nursing will share the courses in general education with other students.

3. The curriculum will offer fewer courses and broader grouping of subject matter. Learning experiences will be carefully organized but flexible enough to provide meaningful learning without unnecessary repetition.

4. Facilities of the community—including hospitals, clinics, visiting nurse associations, convalescent homes, homes for the aged, and nursery schools—will be utilized to provide a variety of learning experiences. No part of the program will be hospital controlled.

5. The nursing program students will enjoy the same status as all other students in the college. They will be eligible for all activities of the college and will be held to the same standards of admission, graduation, and the like.

6. The faculty for the specialized courses in nursing will be selected as are other faculty members. They will enjoy the same privileges and share the same responsibilities.

7. The program will be supported from the same sources and in the same way as other programs. The same tuition fees will be paid by all students.

8. Students will live at home or make their own living arrangements. Most junior and community colleges do not provide dormitories. If they do, students in nursing will be eligible to live in them. No special housing for nursing students will be provided.

9. Students will qualify for the associate degree.

10. Students will be eligible for the licensing examination of the state in which the college is located.

CRITERIA FOR SELECTING COOPERATING COLLEGES

In order to provide for the selection of those colleges best able to cooperate ef-

fectively in the Cooperative Research Project, certain criteria were set up. These should be useful to colleges wishing to determine whether they can qualify for participation in the project and for the research staff in making the selection. The criteria include:

1. Willingness of the college to assume complete control of the program in nursing.

2. Willingness and ability of the college to provide and pay for the new type of program.

3. Willingness of hospitals and other agencies to provide clinical facilities for learning experiences with service as a by-product only. The college will need the kind of community relationships which permit coordination of the various facilities.

4. Availability within the community of adequate clinical experiences in a variety of agencies. This is a quantitative and qualitative measure.

5. Acceptance of the program by the college faculty, and provision for students in nursing to become an integral part of the college and eligible to participate in all its activities.

6. Readiness of the community for this type of program.

7. The school, or division, or department of nursing should be of adequate size. Success of the experimental program will rest upon its cost as well as its quality.

8. Graduates of the program must be eligible for licensure within the state in which the college is located. Licensure laws and regulations differ with the various states. A close working relationship with the State Board of Nurse Examiners is essential.

9. The college should be prepared to carry through the research project to a logical conclusion.

SOME QUESTIONS TO BE ANSWERED

The advisory committee, at its first meeting, assisted in identifying some of the questions which might be answered in the cooperative research project. It is probable that some may be answered fully within the life of the project, others only in part. Answers to some of the following questions should be very useful to those planning for education for nursing in the future.

What is the cost of education for nursing in the new type of program?

What kinds of facilities are necessary for this type of program?

What learning experiences are best in preparing nurses for technical functions?

How do general education and a part in college life affect the product of the program? Is the product usable?

What in-service education is necessary on the part of the employing agency?

Is the program tapping new resources of personnel for nursing? Why do students withdraw? Why are they attracted to this program? What do they do after graduation?

What revision of assumptions is needed as a result of progress of the project?

COOPERATING COLLEGES

Two colleges have thus far established experimental programs in education for nursing and have entered into a cooperative relationship with the project. One, Orange County Community College, Middletown, New York, is a public institution, a part of the State University of New York. The second institution, Fairleigh Dickinson College, Rutherford, New Jersey, is a privately supported four-year institution which also offers two-year terminal programs. Both institutions have received approval to op-

erate experimental programs from their respective State Departments of Education and State Boards of Nurse Examiners. Both institutions offered nursing programs in September 1952 and admitted students in the winter semester.

Other institutions now in the planning stage will join the project by September 1953. At least two more colleges will offer two-year programs at that time. It is anticipated that the remaining colleges will be selected and will offer programs in nursing by September 1954.

SUMMARY

The Cooperative Research Project is concerned with the development of a new type of educational program in preparation for nursing in a selected number of junior or community colleges. The type of program proposed is based upon certain assumptions as to the functions of nursing and as to the essential characteristics of a program in nursing. The first year's activities within the project have concerned themselves with interpretation of the purposes and plans of the project, exploration of potential cooperating institutions, and consultation with administration and faculty of colleges, either those cooperating or those planning programs. The next years of the project will concern themselves more with intensive study within the programs offered by the cooperating colleges and evaluation of the findings.

Teachers College, Columbia University Register of Doctoral Dissertations

ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Volume III, Sixth Annual Supplement, 1952

VOLUME I* of the *Register of Doctoral Dissertations*, covering the years 1899-1936, volume II**, 1937-1941, volume III**, 1942-1946, may be purchased from the Bureau of Publications, Teachers College. The 1947 supplement appeared in the April 1948 issue of *Teachers College Record*, the 1948 supplement in the April 1949 issue, the 1949 supplement in the April 1950 issue, the 1950 supplement in the April 1951 issue and the 1951 supplement in the May 1952 issue.

It should be noted that titles of dissertations not yet published are sometimes changed at time of publication.

This *Register* does not include project reports submitted in partial fulfillment of requirements for the Doctor of Education degree. Two volumes of the *Register of Doctor of Education Reports*, volume I†, 1935-March 1945 and volume II‡, March 1945-December 1951, are available from the Bureau of Publications, Teachers College.

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REVIEWS

An Introduction to Education in Modern America, by Gordon C Lee. New York, Henry Holt, 1953. xiv + 555 pp. $4.50.

One of the curious things about American educators is that while they have for over a century proclaimed the ultimate popular control of the public school, they have done little to educate the American people to the peculiar responsibilities thereby involved. Youngsters who today finish twelve years of public schooling have learned little if anything of a formal nature about how public schools came to be, how they are supported and maintained, how educational policies are made and carried through, and what the citizen's responsibility is in all of this. It is true that the youngster carries away with him a multitude of "impressions" about our schools—usually hazy generalizations of his own particular school experiences. It is little wonder, then, that when these boys and girls in their turn become parents and school-board members, they often find it difficult to comprehend and accept increasing budgets and changing pedagogical ideas.

The problem at the college level is perhaps even more acute, for here are assuredly the lay leaders of the not-too-distant future. Nevertheless, the shortcoming is much the same. At many colleges there is no opportunity at all to study carefully and critically the nature and problems of our educational institutions; at others, these are matters reserved exclusively for teachers-in-training. That more than this is called for has been pointed out often and well in the journals of higher education. (See, for example, Francis H. Horn, "Education Among the Liberal Arts," *Journal of Higher Education*, Vol. XXII (1951), pp. 411-17, 457.) Surely, in these years of educational strife and controversy a rigorous introduction to education for non-educators should be available in the social science faculty of every college in the country.

Undoubtedly, Dr. Lee's textbook will do much to advance this cause. It is prepared for those who are not contemplating teaching as well as for pre-service teachers; and its worth for both groups is unexcelled. The volume is divided into seven parts: (1) the nature of American society; (2) conflicting purposes for American education; (3) the organization of American education; (4) the administration of American education; (5) the preparation and selection of teachers; (6) organized social forces and American education; and (7) fundamental problems in contemporary American education. Each part consists of several short chapters, and each chapter includes a number of questions for study and discussion and a useful, up-to-date listing of several dozen references for further reading. There is a well-made index at the end.

The first five parts present a wealth of useful and significant data culled from a wide variety of recent research studies, while the mere inclusion of parts six and seven makes the text noteworthy in its field. In part six, Dr. Lee discusses the influence on American education of the mass media of communication, of organized business and labor, of the churches and political parties, and of organized private philanthropy. The growth of these vast and powerfully organized interest groups since 1900 is clearly one of the central facts of modern American history. Nevertheless, the extent to which such forces—repre-

senting legitimate articulations of diverse publics regarding educational policy—are ignored in contemporary educational theory is alarming. Doubtless Dr. Lee's previous researches into the pressures for and against federal aid between 1870 and 1890 have sensitized him to the problem. His presentation here is illuminating, and will serve to introduce the reader to some of the most important contemporary questions in educational policy making.

In treating carefully and critically such problems as the role of religion in public education and the meaning of academic freedom in the present period, the author is also breaking ground for a text of this sort. No thinking person who has read the newspapers in recent years can be unaware of these problems, and the teacher who ignores them imperils not only his own intellectual security but that of his fellows in the profession.

Throughout, the volume is distinguished for its clarity (jargon and pedagese are completely absent) and its reliance on worthy sources. In many places Dr. Lee has presented issues by quoting from well-known opponents on given points of controversy. He is always the teacher rather than the preacher—unless, perhaps, he is preaching for a public school system sponsored by an educationally literate citizenry and staffed by a socially literate profession. Here is a truly rewarding introduction to education in modern America.

LAWRENCE A. CREMIN
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Essays on the Sociology of Knowledge, by Karl Mannheim (Edited by Paul Kecskemeti). New York, Oxford University Press, 1952. viii + 327 pp. $6.

This volume makes available in English six early articles by Karl Mannheim published before the Nazi accession. The essays fall into two distinct groups. The first three outline the essential elements of a sociology of knowledge: a world outlook, a philosophy of history, and a definition of appropriate problems. The second section applies the sociology of knowledge to three problems: competition, economic ambition and its educative effects, and the problem of generations.

Mannheim is anti-positivistic, and rejects relativism in cultural analysis. His apparent relativism is the effect of his insistence that understanding of a culture requires partipation in it, acceptance of its total structure, and, only then, analysis of the relation of different institutions to its total structure. This position, happily, permits the student of society to regard cultural products as valid "relative to the given society," while treating them as determined by the particular societal structure. One may have his relativistic cake and be forced, deterministically, to eat it too.

Mannheim therefore sees the task of the social analyst as finding as comprehensive a whole as he can which characterizes the society, a kind of root idea of the culture. Once this world outlook is found, he can account for interrelations, sources, and meanings of institutions in the culture. This is essentially a historical task; and, for Mannheim, historicism is the *Weltanschauung* of our time, that outlook which deals with the world outlooks of different periods of history as the data pertinent to a total understanding of the course and final meaning of history.

Historicism is a valuable science in modern society, since it enables the student of sociology to transcend the partisan, class-structured interests around which world outlooks tend to polarize in a social structure. The sociology of knowledge Mannheim treats as the branch of historicism which deals with thought as the product of social stratification, conflict, and competition. "We must first identify the various 'world postulates,' systems of *Weltanschauung*, combating each other, and find the social groups that champion each; only when these 'intellectual strata' are specified, can we ask which 'social strata' correspond to them." (p. 186) Mannheim

points out that the sociology of knowledge thus corrects Marxism, in treating the proletariat as having more than one historical perspective, not as being driven by a single point of view in history. He is Marxist in his emphasis upon the decay of the bourgeoisie and rise of the proletariat as motivating factors in contemporary history, but he takes ideas a great deal more seriously than do the Marxists, recognizing that they have a special character and power of their own in spite of the fact that their class origins can be traced. For example, the study of competition and success as motivating *ideas* in Western culture is remarkably cogent in its application to both communist and capitalist systems. And in the course of his analysis of the polarization of party interests around opposing ideas, he insists on the necessity of synthesis in knowledge, the discovery of great integrative ideas, as a means to overcoming the divisive effects of such polarization.

The educator will find in these essays two elements of great value. The first is the careful analysis of the educative effects of institutions other than schools, in particular the studies of competition, ambition, success, and position in age groups. These suggest a problem too often neglected in educational theory: the effect of career expectations upon intellectual interests. The second is the application of Mannheim's theories to the selection of guiding principles for the organization of educational institutions. These bear principally upon the choice of purposes and policies in the school system. Unfortunately, they seem to support primarily those who think the educational task is properly defined by establishing a total perspective from which a valid outlook on any particular matter can be determined. It then follows that educative processes can be set up for developing the outlook, ideas, and technics by which the overarching point of view can be sustained, and for assigning particular educational tasks to the appropriate social classes.

This point of view is not "developmental." Mannheim, indeed, rejects the developmental approach as "static" and deterministic. He views development as the working out of predetermined courses of behavior, rather than as the exploratory process of creating new configurations of ideas out of old and new experience. This concept is perhaps due to his lack of a theory of motivation in learning, other than his brilliant sense of economic motivation.

But the real difficulty lies in Mannheim's theory of knowledge. If knowledge is to be understood and communicated through grasp of a total view and analysis of its parts, then education naturally becomes a process of "making" knowledge out of deductions from assumptions about life's meaning. It then follows that Mannheim is correct in assuming that the principal educational task is establishing the validity of one's initial assumptions, their comprehensiveness and totality. And no one would be more surprised than he to find his theories applied in support of an authoritarian educational system. But such an application is a genuine possibility. It should teach us the proper value of an instrument for determining both the limitations and the consequences of our ideas. The sociology of knowledge certainly defines the limitations, but it does not adequately indicate the probable consequences of ideas. His failure to test this method for its possible uses and consequences accounts in part for the way in which Mannheim's thought lends itself to attack upon the very institutions and values which he held in high regard.

MARGARET FISHER
Teachers College, Columbia

Rendezvous with Destiny: A History of Modern American Reform, by Eric F. Goldman. New York, Alfred A. Knopf, 1952. xiii + 503 pp. $5.

Books written by professors of history have seldom enjoyed wide reading in this country. By and large, American readers have preferred historical fiction or history

written by nonacademic and journalistic popularizers. Judging from the way publishers promote the sales of their historical novels with pictures of hypermammillary young females, the motivation for reading the former is not entirely to quench a thirst for historical knowledge. But readers of historical nonfiction have generally avoided the academic historian in favor of the journalist for somewhat more justifiable reasons. Too many products of the seminar and the professor's cubicle have been so very narrow in scope that they have attracted only other specialists, and too many have been shunned because they are handicapped by a dull and pedestrian style. Since much of the work of the journalistic historians is lacking in scholarship, full of factual errors, imagined conversations and events, and dubious interpretations, general readers who have not felt up to wrestling with the prose of the sweating professors have all too often been reading poor history if they read any at all. This undoubtedly overstates the case, but it is largely the unfortunate truth.

But here is a book by an academic historian—Goldman is an associate professor of history at Princeton—that is a brilliant exception to the gloomy pattern. *Rendezvous with Destiny* is broad in scope, careful in scholarship, and sparkling in style. Here is a history that general readers will enjoy as they read something worth while.

Goldman's subject is the social ideas of American liberals—an inadequate term he admits is "quite obviously headed for semantic bedlam"—from the days of Grant and Tilden to the days of Taft and Truman. There is just enough of the thought of the conservatives to present a foil for their opponents. He considers reformers in many fields and of all shades of the political spectrum from the faintest pink to the brightest red. Marching through these pages are such politicians as Tilden, Bryan, Debs, Wilson, both Roosevelts, and Truman; such journalists as William Allen White, Walter Weyl, Herbert Croly, and H. L. Mencken; and such academic greats as John Dewey, Charles Beard, Vernon Parrington, Franz Boas, and E. A. Ross. Handling such a vast dramatis personae definitively is of course impossible, but Goldman has a good knack at writing an accurate and revealing sketch and at turning up the quotation that summarizes a book. There is little new knowledge in this work, but there is provocative interpretation for those who know the field well and a wealth of well-presented information for those who do not.

In writing of these reform movements and ideas the author raises a great many questions which plague liberals today. One such question is the problem of war and peace and its relationship to domestic reform. There is the question of governmental centralization, which has bothered liberals since the time of Jefferson. As Parrington put the question, "We must have a political state powerful enough to deal with corporate wealth, but how are we going to keep that state with its augmenting power from being captured by the force we want it to control?" And there is always the question of ends and means: do ends ever justify means and do dubious means always distort ends? These are some of the questions that American liberals in Goldman's pages concern themselves with, and they are among the questions that should continue to bother progressives.

Here is a book that takes aim at the general reader and with rare rhetorical brilliance and drama hits the target, and this reviewer hesitates to criticize anything about it which may make it attractive to a broad audience. But does the use of sensational chapter titles really make a book more attractive? A person picking up a book for the first time logically looks at the table of contents first. When he looks at Goldman's table of contents, instead of learning in a rough way what each chapter is about, he finds that the first chapter is called "Bejabbers, I'm Worth Me Thousands," the seventh is captioned "God-Dammit, Let Them Build It," and the seventeenth is entitled "Down, Down, Down."

This reviewer does not know enough of the ways of publishing to judge whether or not such a device makes up enough in appeal to offset the inconvenience of those who like a table of contents to be descriptive, but he has his doubts. This is a minor quibble, however. If the reader goes beyond the table of contents, he is in for a rich experience.

DAVID A. SHANNON
Teachers College, Columbia

American Universities and Colleges (Edited by Mary Irwin). Washington, D.C., American Council on Education, 1952. xi + 1105 pp. $10.

The first edition of this widely used reference book appeared in 1928 with a listing of 399 colleges and universities. Since then it has passed through six editions, the current one describing no less than 904 accredited institutions. By comparing the information on colleges and universities in the various editions, it is possible to trace the main lines of the recent development of American higher education.

The sixth edition of *American Universities and Colleges* differs from its predecessor (1948) in several respects—increase in number of pages and in price; the inclusion of a new chapter, "Recent Trends in Higher Education," by Francis J. Brown, in the introductory part of the book; new editorship (Mary Irwin was elevated from the assistant editorship to replace A. J. Brumbaugh); the inclusion of data about ROTC units; and the reorganization of the institutional descriptions by states, rather than by the customary single alphabetical sequence. Otherwise, this valuable reference work has undergone no real basic change. The information on the individual colleges and universities continues to be derived from administrators' replies to questionnaires. The format and the general arrangement of the content remain the same. Thus, Part I is made up of six chapters of foundational material; Part II, of "Institutional Exhibits"; the third section, of appendixes dealing with accrediting associations, degree abbreviations, ROTC units, and various classifications of colleges and universities; and the final section, of general and institutional indexes.

Superficially, there seem to be several changes in the content portion of the volume; that is to say, the sections containing background information are frequently identified as being the work of new authors. This is in the nature of an overstatement. Most of "Education in the United States" (pp. 3-13), by Lloyd E. Blauch, has been carried over, with minor modifications and with many identical paragraphs, from M. M. Chambers' essay in the previous edition. The editorial note to the effect that Dr. Blauch "revised the chapter by M. M. Chambers . . . by bringing statistical and other factual matter up to date [and] has also written much new material" is not borne out by a comparative examination. Simple justice, bibliographical and otherwise, would have required the addition of Dr. Chambers' name as co-author, a practice which was followed in the case of the chapter, "The American University" (pp. 45-68), where, under identical circumstances, the authorship is given as Donald H. Daugherty and Lloyd E. Blauch.

A similar situation exists with reference to a number of sections comprising the chapter, "Professional Education." A side-by-side comparison of the sections on agriculture, business administration, engineering, home economics, journalism, and pharmacy reveals that much of the material was taken from the fifth edition and that, after more or less minor alterations and additions, the name of a new author was substituted in each case.

It should not be assumed, however, that the content chapters present nothing that is new. In the area of professional education there are new sections on the Bible, osteopathy, and veterinary medicine, a rewritten account of dentistry, and a fresh treatment of nursing education. The last-named material, incidentally, abbreviates the histori-

cal background, which is so useful in the description of the situation in the other professional fields. Changes are also evident in the chapter "The Foreign Student in the United States," with Kenneth Holland replacing the late Laurence Duggan as author. An unfortunate omission is the table on the number of foreign students in the United States since 1928.

Spot checks of the institutional exhibits indicate that, by and large, there have been few fundamental changes since the fifth edition. Furthermore, the current volume, which made its appearance in the spring of 1952, was already out of date on the day of publication, in that such significant developments as rises in tuition rates and the GI Bill of Rights for Korean veterans rendered some of the information obsolete. All of which raises the question of the necessity of a new edition every four years or so. It would seem that semiannual or annual supplements, together with a complete revision at intervals of say ten years, would make this reference book of greatest functional value.

In his foreword, Arthur S. Adams, president of the American Council on Education, states that *American Universities and Colleges* "has long been recognized as a standard reference volume on higher education." In spite of the questions raised in this review, the writer agrees with this opinion. The book has considerable utility for a large variety of people—librarians, educationists, guidance counselors, college administrators, editors and writers, parents, and students.

The American Council on Education should be congratulated for maintaining in print its trio of valuable reference works—*American Universities and Colleges*, Jesse P. Bogue's *American Junior Colleges* (third edition, 1952), and M. M. Chambers' *Universities of the World Outside U. S. A.* (1950). It is to be hoped that it will expend every effort to render them even more serviceable than they have been hitherto.

WILLIAM W. BRICKMAN
New York University

Origins of American Scientists, by R. H. Knapp and H. B. Goodrich. Chicago, Illinois, The University of Chicago Press, 1952. xiv + 450 pp. $7.50.

This is an admirable piece of work. It is a lucid, persuasive report of a well-planned, thorough investigation into matters of great academic and, indeed, social significance. It presents all of the data collected, explains all of the analytical techniques employed, and sets forth and interprets the findings—in detail and in summary—with great expository skill. The authors, the Committee of the Faculty of Wesleyan University under the direction of which they worked, and the Carnegie Corporation, which helped to finance the study all deserve congratulations.

The purpose of the investigation was "to discover what factors have in the past been most important in interesting undergraduate college students in science as a vocation." The first steps were to identify a population of 18,000 outstanding American scientists, discover when and where they had received their Bachelor's degrees, separate out the males among them who had graduate between 1924 and 1934 (inclusive), obtain estimates of the total number of male graduates during that period from each of the 489 colleges and universities involved, and then derive a productivity index for each such institution. The list of fifty colleges and universities with the highest indices—ranging from 131.8 per thousand for Reed and 70.1 for Cal Tech at the top, to 24.7 and 24.6 respectively for Lebanon Valley and South Dakota School of Mines at the bottom—was then scrutinized to obtain leads for further digging.

Next a homogeneous sample of 153 colleges of liberal arts and a sample consisting of the 84 largest universities of the nation were established and a variety of data regarding each was collected. Such data had to do with location, control, presence or absence of fraternities, size, student mortality, proportion of male to female graduates, student-faculty ratio, proportion of

science to all teachers, proportion of junior faculty members, financial condition of the institution and costs to students, entrance requirements, and proportion of staff with Ph.D. degrees. In the cases of fifty of the colleges comparable indices of student quality proved available.

Elaborate statistical manipulation of all these data revealed certain significant correlations between the magnitude of the productivity index and certain of the variables just noted. This led to the next step in the inquiry—intensive case studies of twenty-two of the colleges chosen because of indications that a deeper knowledge concerning them would throw additional valuable light on the matters under examination. The colleges selected were: (1) four institutions of broad intellectual emphasis—Reed, Swarthmore, Oberlin, and Antioch; (2) five men's liberal arts colleges —Amherst, Haverford, Wabash, Wesleyan, and Williams; (3) seven western liberal arts colleges of distinguished performance in the production of scientists—Central (Missouri), Colorado, Cornell (Iowa), Earlham, Kalamazoo, Marietta, and Whitman; (4) two prosperous colleges of superior achievement—Pomona and DePauw; (5) two colleges of minority constituency—Hope and St. Olaf; and (6) two colleges of special interest because of their achievement despite profound disadvantages—Iowa Wesleyan and Linfield. These case studies, by no means limited in attention to the teaching of science, are fascinating indeed.

But the case-study step did not complete the inquiry. Elaborate questionnaires had been dispatched to alumni of the twenty-two institutions who had taken the Doctor's degree in science, and the responses (from 60 per cent) were carefully analyzed. These questionnaires dealt with the respondent's pre-college background and choice of a college, aspects of the institution he attended, his choice of a major, his department of specialization, his undergraduate teachers, and his graduate study.

When the results of all parts of the study had been brought together the authors wisely permitted themselves to speculate about the findings. Among these were the following: (1) the optimum size for the production of scientists was that of an institution graduating from forty to one hundred and fifty students annually; (2) the Middle and Far West were easily the most productive regions; (3) Catholic institutions were far less productive than the rest —among whom control differences had little significance; (4) schools of technology and engineering schools generally did not achieve the national productivity average, in this respect lagging behind schools preparing for vocations resting on the biological sciences; (5) the colleges of liberal arts were easily the chief source of scientists; (6) among these, the index of productivity correlated significantly with the intellectual quality of the student body; (7) medium-cost institutions were most productive except in the case of high-cost institutions without fraternities; (8) among the universities, a low student-to-faculty ratio was favorable; (9) the South was singularly effective in the production of mathematicians, the Far West of physicists; (10) the most productive departments were marked by a greater degree of social interaction among faculty and students and of severity of major requirements; (11) the most influential teachers were distinguished as to (*a*) energy, demandingness, masterfulness, and enterprise, (*b*) social accessibility, personal warmth, and breadth of interests, and (*c*)—though the evidence was here less certain—intellectual and professional stature and personal dignity.

In their effort to explain their findings the authors draw impressively on postulates from the disciplines of history, psychology, sociology, and pedagogy. Their emphasis comes to rest on the influence of prevailing ideas in the sub-cultural groups to which students belong before they even enter college, especially when these ideas are reinforced during undergraduate days. Favorable to the selection of science as a field for one's life work is a background of secularized Protestantism, of neither-too-close-nor-

too-far-from-the-frontier contacts with nature, of middle- and lower-middle-class individualism and social mobility—mobility from a starting point below the socio-economic level represented by the life of a scientist. In addition, the character and appeal of the smaller college, with its limited vocational emphases, faculty preoccupation with teaching, and low level of extra-curricular distractions, are underlined. Finally it is suggested that the influential teacher may be seen as a father figure who serves as "(1) an object of admiration and emulation; (2) a source of coercion; and (3) an understanding confidant."

Throughout their book Knapp and Goodrich impress the reader with their scientific caution, warning him continually of the special character of this particular study, the limitations that characterize some of their data and techniques, the points at which subjective elements are necessarily operating. For example, after interpreting their findings respecting eminent teachers they say that "it is only proper to admit that the pattern described here may be an artifact of the sample of our institutions studied," further remarking that "whereas we have defined a single type of teacher who seems to have achieved conspicuous success, successful teachers are to be observed, even within our limited sampling, who but very imperfectly meet these qualifications." They might have added (though they could reasonably expect their readers to realize it for themselves) that inferences regarding teachers of other than scientific subjects and of more recent times should be drawn from their findings only with the greatest caution.

Teachers colleges are given little attention by Knapp and Goodrich, who remark that "it will come as no surprise . . . that teachers' colleges and normal schools are quite consistently low in the production of scientists." The remark is just, for of course those institutions were, between 1924 and 1934, chiefly devoted to preparing students for elementary school teaching and rarely had extended offerings in the fields of science. Nevertheless the master-list of productivity indices of all 489 institutions reveals that some teachers colleges, even twenty to thirty years ago, compared favorably with institutions of considerably wider reputation. For example, the performance of both Illinois State Normal University and Southern Illinois Normal University surpasses that of the University of Illinois; indeed the former is ahead of every state university in the country except Connecticut, Idaho, Massachusetts, Montana, and Wisconsin, and also has a better record than such private institutions as Columbia, Harvard, M. I. T., Princeton, Stanford, Vanderbilt, and Yale. Northeast Missouri State Teachers College and Nebraska State Normal College also have a better record than the Universities of Missouri and Nebraska respectively; while Western State College of Colorado, Michigan State Normal College, and West Texas State Teachers College are each only a little behind the public universities of their states.

There is reason to suspect, moreover, that the relative productivity of the teachers colleges has improved since 1924-34. Most of those in the West and Far West have greatly increased their liberal arts offerings since then. With their low tuition rates they may now be attracting a larger proportion of students with the backgrounds that Knapp and Goodrich have established are—or at least used to be—conducive to entrance in careers of scientific scholarship. The possibility that their productivity, as a group, has now risen gains further support from a scrutiny of Appendix 6, which gives comparable indices in the cases of the eighty-four universities, for the periods 1924-34 and 1930-41. The third of these institutions showing an increase in productivity are the ones that, on the whole, had the lowest indices in the earlier period. Moreover, more than half of them fall into the categories (in descending magnitude) of urban-municipal and Catholic institutions. This suggests some interesting shifts in the forces that make for the production of scientists.

Perhaps, indeed, the main warning that Knapp and Goodrich fail fully to give their readers is to remember that much has happened in the academic world and our society since 1934 which may have altered the earlier picture which they have painted. Fortunately, however, we may soon hope to receive from Knapp and a new collaborator a study of more recent and more inclusive data. This work, dealing with young scholars in all academic fields who emerged between 1946 and 1951, will be eagerly awaited. In the meantime we may be grateful for what has already been received.

KARL W. BIGELOW
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Child Development: The Process of Growing Up In Society, by William E. Martin and Celia Burns Stendler. New York, Harcourt, Brace and Company, 1953. xxii + 519 pp. $4.75

The authors wrote this text out of the conviction that child development is an interdisciplinary social science and that development cannot be fully understood except as related to a particular society, as a process influenced by social conditions. To state their case they devote two-thirds of the chapters and three-fourths of the pages to a discussion of society, culture, socialization, and the socializing agents.

Does this emphasis on social and cultural factors limit the book's usefulness?

Actually, there is a balance in discussing varying points of view throughout the book. The descriptive, normative picture of development is rejected but is given full appreciation. The child is seen as the wise chooser but there are also many things about which he is unwise and for which he needs guidance. The authors counter the need for gearing training to maturation with the warning that "innate factors are at work but require environmental opportunity." A chapter is devoted to an exposition of the psychoanalytic approach to development, and although critical, the authors recognize its influence. While much is made of cultural impress upon personality, the reader is warned not to "conclude that culture has members of a society in a vise and patterns their personalities irrevocably in a particular way." And, finally, after adaptation to various cultures has been described, the reader is warned against cultural relativism: "While it is important . . . to appreciate the variability of personality, the nature of the child sets limits to the personality patterns that can develop. Also students must not draw the conclusion that since each personality type fits a particular society, all basic personalities are equally good."

There is much else that is good about the book. Careful selection of crucial studies to illustrate major points makes for tightly integrated discussion, especially in the first part of the book. This is less true of the social-cultural section, for here the authors have brought together most of the research contributing to an understanding of growth in culture and in American society in particular.

There are technically good things. The style is readable with an unpedantic integration of research findings. Summaries are frequent, the questions following sections within chapters are useful and often even striking (e.g. the use of a Kafka quotation). The bibliography is select and annotated, examples are taken from child behavior, and illustrations are copious and amusing.

As for adverse criticisms, the reader gets little sense of the emotional impact of "growth-in-culture." Growing personalities are presented as organic beings, certainly as social beings—but hardly at all as emotional reactors who have problems that impinge upon and perhaps hamper function. Unfortunate is the omission of a discussion of guiding development toward the "healthy personality," a discussion which so fruitfully occupied the most recent White House Conference. Unfortunate, too, is the absence of Erikson's discussion of psychoanalytic stages as mediated by social agents,

relating biological tension with the socializing matrix, in the chapter on the psychoanalytic point of view.

Although there is good reason to discuss development from age one to adolescence in the context of culture and personality, these growth periods warranted chapters equivalent to the chapter discussing growth to the first year. Growth and motor factors were allotted little space because of this. Certainly, the pre-schooler and the adolescent are undergoing growth changes that are crucial to their behavior.

In the enthusiasm for cultural influences on development there is an occasional questionable intrusion—for instance in the discussion of birth rites in various cultures.

There are those in the field, surely, who would regard not only this but even many chapters as out of place in a child development text.

For this reviewer, this was a text long in coming. In rejecting the "age" normative approach, or the social, emotional, motor, and so forth, "area" approach, the authors have written out of a theoretical integration that gives further credence to Child Development as the interdisciplinary social science par excellence. I can well see many teachers using this text for the optimum discussion of social and cultural factors, but finding it necessary to bring in other materials to give equal weight to such concepts as organismic age, a developmental philosophy, motor and physical factors in the chronology of growth, and the emotional impact of "growing up."

MEYER RABBAN
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Measurement in Education, by A. M. Jordan. New York, McGraw-Hall, 1953, xi + 533 pp. $5.25.

The nineteen chapters of this volume, which was written for use as a text in beginning courses in educational measurement, fall into five groups: (1) general considerations in measurement, with an introductory chapter and chapters on the characteristics of measuring instruments (validity, reliability, etc.); the construction of achievement tests, and the testing program (assembly of test batteries, etc.); (2) nine chapters describing and discussing specific tests in various subject-matter fields; (3) two chapters on the measurement of intelligence; (4) chapters on the measurement of interest, attitudes, and personality traits; (5) a twenty-one page chapter on certain statistical concepts.

By far the largest part of this book is devoted to descriptions and discussions of specific tests. So far as the reviewer observed, this material meets a high standard of accuracy and usefulness. Information of this sort should orient the prospective teacher in the field of practical testing and provide a convenient source of reference for the administrator or the classroom teacher. Perhaps the most striking omission is the absence of any mention of projective techniques for personality study, but this may be justified on the ground that their use is beyond the scope of beginning students of measurement.

The author does not differentiate between standard measures and normalized standard measures. This leads to confusion in several places. On pages 192-93, for example, most readers would probably get the false impression that Cooperative Scaled Scores are the same as McCall's T-Scores except for a difference in the basic reference group. Attempts to develop meaningful units of measurement have led investigators from standard scores to T-Scores to Cooperative Scaled Scores to Gardner's K (for Kelley) Scores; but this line of development, the nice distinctions among the types of scores, and a consideration of their merits and demerits do not appear in the volume reviewed.

In discussing test reliability the author never suggests the deliberate matching of half scores instead of relying on chance to provide equivalence of halves determined by odd-and-even numbered items. Neither is there a warning about the misuse of any

split-half or analysis-of-variance method to compute the reliability of speeded tests. Indeed, in connection with Kuder-Richardson Formula No. 21 the author unfortunately gives further circulation to the half-truth about this formula always yielding an underestimate of reliability.

The author's discussion of correction for chance success (pp. 51-52) will, in the reviewer's opinion, serve to mislead rather than to inform students. Basically, the purpose of the correction is ordinarily to obtain scores that provide a rank order of examinees more closely approximating the rank order of their true scores in the variable it is desired to measure than will a rank order in terms of uncorrected raw scores. It can be shown analytically that the conventional correction for chance success will accomplish this result, provided that every examinee who does not possess enough knowledge to identify the correct answer to an item marks the correct answer only as often as would be most probable if he guessed among *all* of the choices (both correct and incorrect) in that item. In actual practice, the two most common violations of this assumption (in the case of a well-constructed test) tend to cancel out each other's effects. Empirical data presented by Bryan, Burke, and Stewart and by the reviewer lead to the conclusion that the use of corrected scores does more closely approximate the rank order with respect to true score in the variable it is desired to measure than does the use of raw scores. This is especially true in the case of difficult and highly speeded tests. But even when the approximation is insignificantly improved, correction for chance success permits the use of honest, straightforward, unambiguous directions that engender among laymen confidence and respect rather than cynicism and even dishonesty. It is unfortunate that the author gives the impression (p. 52) that a choice must be made among the two sets of directions he quotes. Ordinarily, it would be better by far to use directions such as: "You may answer items even when you are not sure that your answers are correct, but you should avoid wild guessing, since wrong answers will result in a subtraction from the number of your correct answers." Scoring should then include the conventional correction for chance success.

The author's illustration of test scoring (p. 52) involving cautious and venturesome individuals is not meaningful because both individuals are assumed not to have identical true scores with respect to the variable measured. If this assumption were made and the various score probabilities worked out, the reviewer believes that it would be found that their differing personality characteristics would influence corrected scores less often than raw scores.

Statisticians will not like the procedure (p. 515) for estimating the sampling error of a correlation coefficient. Since references to David's tables or the z transformation are probably beyond the scope of the book, it might be best to delete this material and simply make reference to a more advanced text.

The style, format, and typography are good. The volume will serve a useful purpose in making information about a wide range of tests conveniently available to students, teachers, and administrators.

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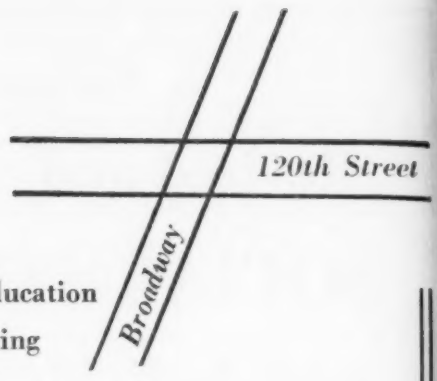

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